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VOL. XIV. NEW YORK, AUG. 31, 1889. No. 9.

The Paris Electrical Conference. We present on the next page a very full and interesting cable dispatch from our special correspondent in Paris in regard to the International Electrical Conference now in session. These conferences, dating from that held in Paris in 1881, have been a great benefit to electrical science and industry, and as Mr. Wetzler says, there are indications that the present meeting will fully equal its predecessors in interest and importance. The conference has already mapped out its work and settled down to business, but no matter how hard it works it will leave many questions for further consideration at the American Electrical Conference of 1892, to be held in connection with the World's Fair. The picture presented by our correspondent of the Paris Conference is a lively one, and will cause many of us to regret that it has not been our good fortune to participate.

Electrical Inspectors. MR. M. D. LAW, the well-known electrical engineer, of Philadelphia, has a few pithy words in our present issue in regard to the inspection of stations and circuits. It will be seen that he desires to have the New England Exchange system applied throughout the country. Sooner or later something of this kind must be done.

Armature Measurements. WE publish an interesting article this week by Mr. E. S. Ferry on methods for determining the equivalent area of dynamo armatures. The method suggested or employed is not unlike that used, we believe, some years ago in England, in testing a Mather & Platt machine, and was, unless we are mistaken, devised by Ayrton & Perry. The article is well worthy of perusal by our readers interested in this line of investigation.

The Study of Electrical Engineering. THE study of electrical engineering is being fostered at so many of our American seats of learning that there can no longer be any doubt as to the adequacy of the supply of electrical engineers for the coming developments of the industry, or their proficiency in the various branches of knowledge pertaining to so vast and comprehensive a science. This week we illustrate as an example of the facilities provided for study in the new profession the fine laboratory recently built and equipped at Ann Arbor by one of the best and most progressive of our universities. The University of Michigan, it will be seen, proposes to do as much for Western students as has been done for Eastern by Johns Hopkins, Cornell, Princeton or Columbia, and she is to be congratulated upon her foresight and liberality.

Edison at Paris. ONE of the most striking features of the American part of the Paris Exposition is the magnificent exhibit made by Mr. Edison, and one of the most interesting episodes of the season has been the visit of the great inventor to Paris, to receive the honors paid him not only for his own contributions to the arts and sciences, but as a man eminently typifying and representing American inventive genius. Mr. Edison's personality is one of peculiar charm, while his career has been full of interest alike to foreigners and his countrymen. In order, therefore, to do justice to the remarkable collection of inventions and apparatus shown by Mr. Edison at Paris, and to give the desired continuity to the evolution or progress they are intended to reveal, we have begun in this issue a series of special illustrations on the subject, the text being furnished by Mr. W. J. Hammer, whose enthusiasm is not likely to let the narrative suffer in any way.

The Electric Light in England. OUR English contemporary, the London *Electrician*, publishes in its issue of Aug. 16 a most striking list of the notices served on London and provincial authorities by electric lighting companies as to their intention of going into the electric lighting business. It appears that the extraordinary number of 474 notices have been given—a figure from which some idea of the activity in electric lighting in England, at the present time, may be found. Many of these notices may fail of fruit, but even should the percentage of plans actually carried out be small, the new condition of affairs must be regarded as highly encouraging. England has certainly aroused herself from her apathy in regard to electric lighting and may soon be expected to put herself abreast of the times. It is not likely that the industry in England will ever assume the proportions that it has gained here; but that it will now grow rapidly seems in no way open to doubt.

The Electrical Subways of Paris. SOME time ago we called attention to the fact that the celebrated subways of Paris, in which it was supposed that all the electrical wires could be placed, had proved quite unequal to the demand, and that there would be necessity for a new service. This week we illustrate the manner in which the old sewer subways have been supplemented by a new electrical conduit system. Our article practically includes no fewer than five different methods adopted for placing the light and power wires underground, the best plans appearing to be those of the Edison Company and of the municipality of Paris. One of the methods adopted, that of running a number of conductors of different classes of service through an iron pipe, loosely and in indiscriminate contact, seems to us to be open to many serious objections, and we shall not be surprised to learn that it has been modified. After all, it will be seen that instead of being ahead of New York in this matter of electrical subways, Paris is behind. In due time each city may profit by the other's experience.

Electricity in Mining. SO numerous are the fields of labor that invite the electrical inventor, it is often difficult for him to work persistently in one direction and confine his energies in the narrow channel that will bear him on to success. In the department of electric power alone the opportunities of new applications are well nigh beyond count, yet even there one hardly knows which of the problems to attack first, so inviting are they all. Hence we are glad to see that Mr. Sperry has had the patience and courage to stick steadily at the perfection of a coal cutter, the latest form of which we illustrate in this issue. Such a tool is badly needed, and, as our article shows, Mr. Sperry is already beginning to reap the reward of his ingenuity and persistence. We believe that in a very few years electricity will have become the main agency employed in mining work, and the coal cutter will be one in a long list of special apparatus devised for subterranean operations.

Electric Motor Opportunities IN a large manufacturing town, the advisability of the installation of an extensive electric power central station is now being discussed. The facts appear to be that within a radius of less than two miles, over 900 steam engines are now in use, averaging in capacity about 37 h. p. The longest complete circuit would not exceed five miles. As the load would be practically constant, it is presumed that a 1,000 h. p. compound condensing Corliss engine will be installed, unlimited quantities of water being obtained free from the natural source. A fair grade of coal will cost $1.50 per ton, delivered, while fuel oil can be contracted for at $1.10 per 100 gallons. As a majority of the owners of steam plants now used, admit that a considerable saving will be effected in the operating expenses of their factories, and have furthermore declared their willingness to adopt the electric motor, even at the same cost, in order to do away with some of the inconveniencies necessarily attending the use of steam, it is quite probable that the day is not far distant when we may see in full operation a model central station electric power plant of 40,000 h. p. capacity in this locality.

Pacific Cable Schemes. THE time cannot now be very remote when the project of laying a Pacific cable, connecting the North American continent with the Far East, must be seriously considered. In fact, the indications are not wanting that the hour for action has arrived, and that whatever may be the inducements for delay the motives and incentives for prompt prosecution of the work are greater and overbalancing. News comes from San Francisco that a committee of the Chamber of Commerce there favors the project of laying a cable from San Francisco to New Zealand by way of Honolulu, at a cost of $10,000,000, and proposes that the United States should guarantee 3 per cent. on an investment of that amount by a company formed under the laws of this country. The latter part of the scheme may be ground for its rejection by Congress, but it must be taken for granted that any reasonable scheme put through with English capital, and having English terminal points, will receive imperial and colonial subsidies to that extent, if not to an even larger sum. We believe that in a very few years the cable would prove a profitable enterprise, and it does seem to us that the time has arrived when by such means American commerce and influence should be conserved and promoted throughout Pacific lands and waters. It is to be noted that the San Francisco merchants assume in their estimates that the proposed cable would divert to itself a part of the cable business from Australia now going westward to Europe. The assumption is reasonable, and is borne out by the diversion already effected in regard to a large proportion of mail matter and travel.

Mr. H. P. Brown, of New York. THE sensation of the week has been the publication by the New York *Sun*, on Sunday last, of about five columns of letters between Mr. H. P. Brown and various companies and individuals, in regard to the use of the alternating current and alternating current apparatus as a means of capital punishment in this State. It is evident, if these letters are to be accepted as genuine, that Mr. Brown has cared little for human suffering, but has, as the *Sun* puts it, "made the execution of the law's most solemn and awful decree the instrument of securing a possible advantage in a fight between corporations." Mr. Brown is exhibited as intimating to Mr. Edison that he wants $5,000 in order to "show the lack of efficiency of Westinghouse apparatus, head off investors and prick the bubble." He did not get the $5,000, and so turned his attention to the Thomson-Houston Company, with the hint or threat that if he did not secure Westinghouse alternating machines he would use theirs, saying of the Westinghouse execution apparatus bought for the State: "*I have withstood tremendous pressure and tempting offers to use other machines for that purpose*, but have, nevertheless, kept my agreement to the letter," the agreement or part of it apparently being that one of the Westinghouse machines bought through Frank Ridlon & Company for the State should be put in the hands of Dr. Louis Duncan for test at Johns Hopkins as to the claims of superiority made for it. In short, Mr. Brown appears to have been "on the make" throughout, getting pay from somebody or other, even the State, for alleged work, and changing his friends and front with the utmost readiness. Such practices are a curse to any business or profession, and we trust that this exposure will give the electrical execution law its quietus.

THE PARIS INTERNATIONAL ELECTRICAL CONFERENCE.

By Commercial Cable from our Special Correspondent.

Paris, Aug. 25, 1889.—The prospects for a successful conference here are of the brightest nature possible, and I have no doubt that the meeting of 1889 will be equal in interest and results to any of its predecessors. An informal gathering was held on Friday night at the Hall of the Societé Internationale des Electriciens, a large and influential body, and there was a pleasant interchange of sentiments and a general making of acquaintances, many distinguished men meeting each other for the first time.

On Saturday the conference was called to order in the famous Trocadero by M. Mascart, President of the Committee of Organization. There was an excellent and representative attendance. In his opening address, President Mascart referred to the conferences that had been held before, especially that of Paris in 1881, and he then stated that the programme of the present conference would be particularly devoted to furthering the work of that year, and in perfecting the methods of employing electricity in practical applications. There were important questions before them in regard to measurement of electrical energy in its various manifestations; the measurement of current by absolute standards easy of reproduction; electric meters; the best construction of machines; methods of lighting, etc.

The conference then proceeded to the election of its officers. The honorary presidents chosen were: Sir William Thomson, president of the English Institution of Electrical Engineers; M. Cochery, the president of the conference of

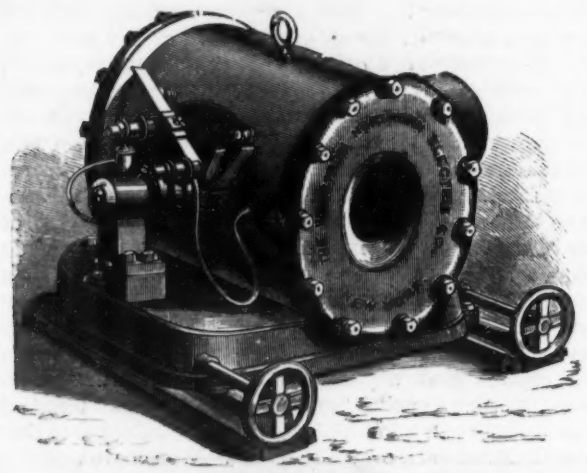


Fig. 1.—The Improved Wenstrom Dynamo.

1881, French Minister of Telegraphs, and M. Berger, director-general of exploitation and honorary president of the Societé Internationale des Electriciens. M. E. Mascart was chosen president. The vice-presidents selected were Prof. Ferraris, the well-known Italian electrician; Herr Kareis, Prof. Potier, of the Ecole Polytechnique; Mr. W. H. Preece, chief electrician of the English telegraphs; M. Rousseau and M. Stoletow. The official reporter selected was M. Joubert, the general secretary of the French Physical Society. In order further to systematize its business, the conference constituted itself into four sections. The first, that of measurements has M. Lippmann as president; the second, industrial applications, M. Potier, president; the third, telegraph, telephone and signaling, M. Fribourg, director of supplies of the French telegraph service; fourth, electro-physiology, Prof. Gariel, of the Medical Faculty, and vice-president of the Societé Internationale.

It was decided to hold the meetings hereafter at the hall of the Societé Internationale, and the conference then adjourned. There were in all about two hundred and fifty delegates present at this opening meeting, of whom naturally by far the larger proportion were French electricians, experts and professors. The attendance of American electricians is not yet very large, but includes T. A. Edison, L. Le Cenci Hamilton, J. W. Crosby, W. J. Hammer, E. W. Hammer, Carl Hering, Georges D'Infreville, F. G. Parsons, E. W. Rice, Jr., E. Thurnauer, E. I. Garfield, of Boston; F. W. Parker, of Chicago; Lieut. Toppan, W. J. Johnston and Joseph Wetzler of The Electrical World; Nikola Tesla, and others. The English Institution of Electrical Engineers is well represented by a large number of its prominent members, including R. E. Crompton, Prof. D. E. Hughes, W. H. Preece, Prof. George Forbes, C. E. P. Spagnoletti, A. Stroh, Sir William Thomson, Prof. Sylvanus P. Thompson, F. C. Webb, Maj. Gen. C. E. Webber, Capt. Sir Douglas Galton, and a great many more. I understand that, all told, nearly 150 members of the Institution will participate in the proceedings of the Conference the coming week.

Among the French electricians present are our old friend Abdank Abakanowicz, Baudot, Berthon, Blondel, Boistel, Prince Bonaparte, Carpentier, vice-president of the Société Internationale; Professor Crova, of Montpelier; Camille A. Faure, Hippolyte Fontaine, Gaiffe, E. Hospitalier, Joubert, Julien, Lemonnier, Lippmann, Mascart, Mercadier, Napoli, Potier, Rechniewski, Reynier, Rousseau, Sarcia, Sartiaux, Sautter, Col. Sebert, of the French Navy; Serrin, Violle, of the Ecole Normale, and Trouvé, who has produced so much ingenious apparatus. There are also present Tresca, Aron, of meter fame; Arrhenius, Banneux, A. Bandsept, of Belgium; C. A. Mourlon, of Brussels; Alexander Bernstein, Prof. Ferraris, J. Kareis, Engineer-in-Chief of the Austrian State Telegraphs; Sawai, of Japan, and Guillaume.

As might be expected, the features of the Exposition have already received considerable attention from the delegates, who have visited the wonderful Eiffel Tower in a body and inspected its electrical plant, by means of which the rays from huge arc light projectors were thrown in different directions across the city of Paris and the surrounding country. A large number of such entertainments and excursions have already been arranged, the hospitality of the French electricians is overflowing, and the general feeling among all the delegates is that the conference is a great success.

News has reached here that Mr. Edison has been created a Count by the King of Italy. Mr. Edison is in receipt of innumerable attentions, and is being feted by everybody, President Carnot included.

Wetzler.

Paris, France, Aug. 26. 1889.—The Conference, after enjoying a very pleasant Sunday, settled down to business this morning. In Section 1, that on Measures and Standards, Bjerknes presented a paper on viscosity, and Sir W. Thomson devoted himself to the subject of electrical measures and measurements. In Section 2, Industrial Applications, the incandescent lamp and questions in photometry were taken up, and the interesting question of simultaneous electric light and heat was also discussed. Prof. Crova introduced the subject in this department. In Section 3, Telegraph and Telephone, the nature and intensity of telephonic effects was the topic of discussion, brought up by M. Mercadier, and various apparatus was noticed, including the monotelephone or electro-magnetic resonator system. In Section 4, "Electro Physiology," the topic of the electrical phenomena connected with the human body, was discussed by Mendelssohn. It will interest many to know that in this section M. Trouvé is to discuss the phases of the electrical execution question. The conference is now in full session, and some valuable results may be expected from its deliberations.

There are many indications that the American exhibits in the Exposition have been greatly appreciated. Nine-tenths of the American exhibitors have received prizes. Of the eleven Grand Prizes, four of them have gone to Americans, as well as six Gold Medals. The American Bell Telephone Company or Western Electric Company, Mr. Edison, Prof. Elihu Thomson and the Thomson-Houston Company, Sperry, and others have had their merits recognized, and the results will be encouraging to those who have been enterprising enough to send their apparatus here.

Wetzler.

In connection with the above cable dispatch, the following special circular from the Institution of Electrical Engineers will be of great interest: On Friday evening, Aug. 23, a joint meeting of the Institution and the Société Internationale des Electriciens will take place at the rooms of the Société, 44 Rue de Rennes (Place St. Germain des Près), at half past eight, when the members will be received by Colonel Sebert, President of the Société, who will inaugurate the proceedings by delivering a short address of welcome. This will be followed by addresses from Sir William Thomson, as President of the Institution, and Monsieur Mascart, President of the Paris International Electrical Congress, 1889. Various instruments and apparatus will be exhibited, including Carpentier's "Melophone," Edison's "Improved Phonographs and Telephones in communication with the opéra," etc. A lecture will be delivered, at a date to be fixed hereafter, at the Central Electrical Laboratory, by Professor Joubert, on "Hertz's Recent Investigations," when most of his experiments will be reproduced. M. Abdank-Abakanowicz will lecture, with full experimental illustrations, on Elihu Thomson's latest electrical investigations, including his electric welding process. On subsequent days, which it is not desirable to fix until the Congress at their first meeting (Aug. 24) have settled the days and times for *their* meetings, the following works of interest will be visited: Messrs. Sauttier-Lemonnier's Works; Messrs. Menier's Cable Works; the Telephone Society's Construction Works; the Central Electrical Laboratory; the Central Electric Lighting Stations at the Palais Royal, the Rue Druot, the Grand Opéra and the Eiffel Tower. Members, associates and students of the Institution of Electrical Engineers to the number of 123 have announced their intention of taking part in the Paris meeting of the Institution.

The Dynamo of the Wenstrom Northern Electric Company.

We illustrate on this page, in Figs. 1 and 2, the new Wenstrom dynamo, being an improved type of a machine that has gained considerable reputation in Europe and is being very successfully introduced in this country.

By reference to Fig. 1, a perspective view, it will be seen that the machine is of the iron-clad pattern, being entirely enclosed in a shell of cast-iron—provision being made to ventilate the armature—with the exception of an entrance on either side, where the armature is slipped between the poles. These poles are four in number, respectively north and south, around the ring, shown in cross sectional elevation in Fig. 2. The exciting coils or helices, two in number, are wound on the two opposite poles, forming two salient poles of similar polarity and two consequent poles between

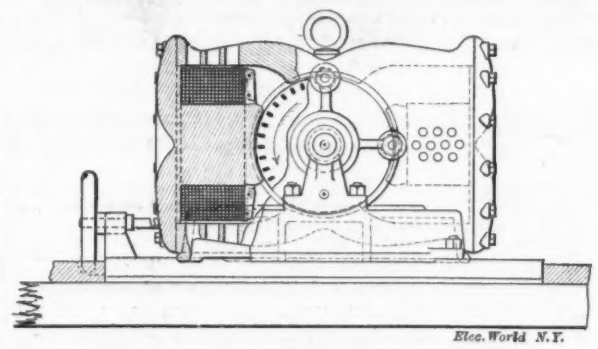


Fig. 2.—The Improved Wenstrom Dynamo.

them, the one pair of coils sufficing to magnetize the complete quadruple circuit, the outer shell of cast-iron forming the magnetic yoke.

The armature is built up of thin iron discs, insulated from one another to prevent heating and eddy currents. This armature has the important advantage that it presents almost its entire surface to the influence of the pole-pieces, as the conductors are wound in grooves or channels of cylindrical or hexagonal form, the entrance to which is formed of a narrow tapering slit, which, after the complete ring is wound, is closed by diamagnetic material, thus enabling the armature to revolve in very close proximity to the pole-pieces, and materially reducing the resistance of the magnetic circuit, and at the same time affording a protection to the electric conductors from the effects of centrifugal force, no binding wires of course being required. A new method of winding the armature is employed, and to enable two brushes only to be used, diametrically opposite sections are connected together, the brushes being set 90 degrees apart.

The following are some data of the recent machines. The 100-light machine absorbs 8 h. p., running at a speed of 900 revolutions per minute. The total weight is 1,100 pounds, consisting mainly of cast-iron, the weight of copper wire on the armature being only 13 pounds, and on the field magnet cores 105 pounds, or 118 pounds of copper in all. The 230-light machine runs at a speed of 500 revolutions per minute, its total weight being 27,000 pounds, of which 39 pounds are of copper on the armature, and 318 pounds are on the field magnets, the remainder being cast-iron. The 800-light machine runs at a speed of 500 revolutions per minute.

The advantages claimed for this construction are that there is no waste field, all the magnetic lines of force being utilized in the armature in producing work; neither is there any field outside of the machine which would be liable to affect watches, etc., all the field being contained within the outer iron shell forming the yoke. Low speed in running is obtainable without increasing the size and weight of the machine, and the whole is cheap to construct, and combines features of mechanical strength and solidity with high electrical efficiency. Finally, the machine is remarkably free from any heating when running constantly and under full load. These machines are manufactured by the Wenstrom Northern Electric Company, of this city.

New Physical Laboratory, University of Michigan.

It is with much pleasure that we are enabled to give our readers an idea by description and illustration of the fine new physical laboratory that has lately been added to the equipment of the University of Michigan, at Ann Arbor, with the special object of carrying into effect the plans of the Board of Regents relative to the course of electrical engineering under Prof. H. S. Carhart.

FIG. 1.—ELECTRICAL LABORATORY ANN ARBOR, MICH.—EXTERIOR AND LECTURE ROOM.

The Physical Laboratory, Fig. 1, was completed a year ago. The entire basement is devoted to electricity and magnetism. The ceiling is 11 feet high, and the floor, two feet below grade, is of German rock asphaltum. The rooms are thoroughly dry and abundantly lighted. The second floor is devoted to the lecture room, Fig. 1, a general laboratory, a balance room, a mercurial room, apparatus room, and two private rooms. The Department of Hygiene is located in the second story. The lecture room, 36 × 38 feet, seats 120 students, and is lighted by five large windows, with semi-circular tops shown at the left in the vignette. In the evening it is lighted with two combination chandeliers of four lights each, besides the table light. Counterweighted black screens permit of completely darkening the room in the day time. The lecture table is supplied with gas, oxygen, electricity, and with water at sufficient pressure to furnish one-quarter of a horse power by means of a small turbine wheel, shown near the left end. The apparatus room is directly behind the desk.

The engine and dynamo room, Fig. 2, 36 × 38 feet, is directly under the lecture-room. Steam is supplied from a boiler house 200 feet distant, and a 25 h. p. Westinghouse engine furnishes the necessary power. The room is abundantly lighted by nine large windows. The open door at the left leads into a large room, supplied with a heavy pier, and intended for the instruments for measuring currents and electromotive forces furnished by the dynamos. The central door leads into a perfectly dark room, painted black, for photometric work. Five other rooms in the basement contain piers for the instruments. Such steadiness is secured that a very sensitive Thomson galvanometer can be used without difficulty in an adjoining room, shown by the sash door in the hall, when the engine is running.

The battery room, Fig. 3, has at present 31 cells of a secondary battery of 125 ampère hours' capacity. The rack is made to hold double this number. Open circuit cells for other purposes are also kept in this room. The water supply, ventilating flue and switch-board are not shown in the cut. The storage battery stands on cork chips. The top cell at the left shows a covering of paraffine to prevent evaporation. It has been on for about six months, and is very satisfactory.

With regard to the work to be done by the students, it may be stated that the intention is that the course of study shall lead up to the degree of Bachelor of Science in Electrical Engineering. The course is parallel with those in civil, mechanical and mining engineering, with the same requirements for admission.

The course of study will include five courses in mathematics, four in French and German, one in English, three in general physics, two in chemistry, four in drawing, one in civil engineering, eight in mechanical engineering, and at least four courses in electrical engineering. The remainder of the work necessary to graduation will be elective, and a satisfactory thesis will be required for a degree. The first three years of the course will be nearly the same as in mechanical engineering. Besides the preliminary work in mathematics, languages, drawing and physics, instruction will be given in pattern making, metal work, forging and foundry work in the mechanical laboratory; and enough of the study of steam engines and other prime movers will be included to meet the needs of the professional electrical engineer. The special electrical courses, additional to the elementary study of the subject, will be devoted to primary and secondary generators, electro-metallurgy, electrical units and methods of measurement, dynamo-electric machinery, arc and glow lamps, photometry, and the distribution of electricity and transmission of power. In addition, elective courses in mathematical electricity will be offered, and the student will be advised to avail himself of such opportunities.

The laboratory work in electricity will be devoted mainly to the investigation of primary and secondary batteries, to practice in making electrical measurements of precision by all the best methods, to setting up and testing dynamos, motors and storage batteries for efficiency, to photometry of both arc and glow lamps, and to special investigations connected with the preparation of a thesis. Occasional complete tests of central electric light and power stations will be undertaken, and the student will be made acquainted with the best practice in electrical manufacturing and engineering by visits to places where such enterprises may be seen on a large scale.

We are indebted to Prof. H. S. Carhart for his courtesy and kindness in furnishing us with information on the subject as above.

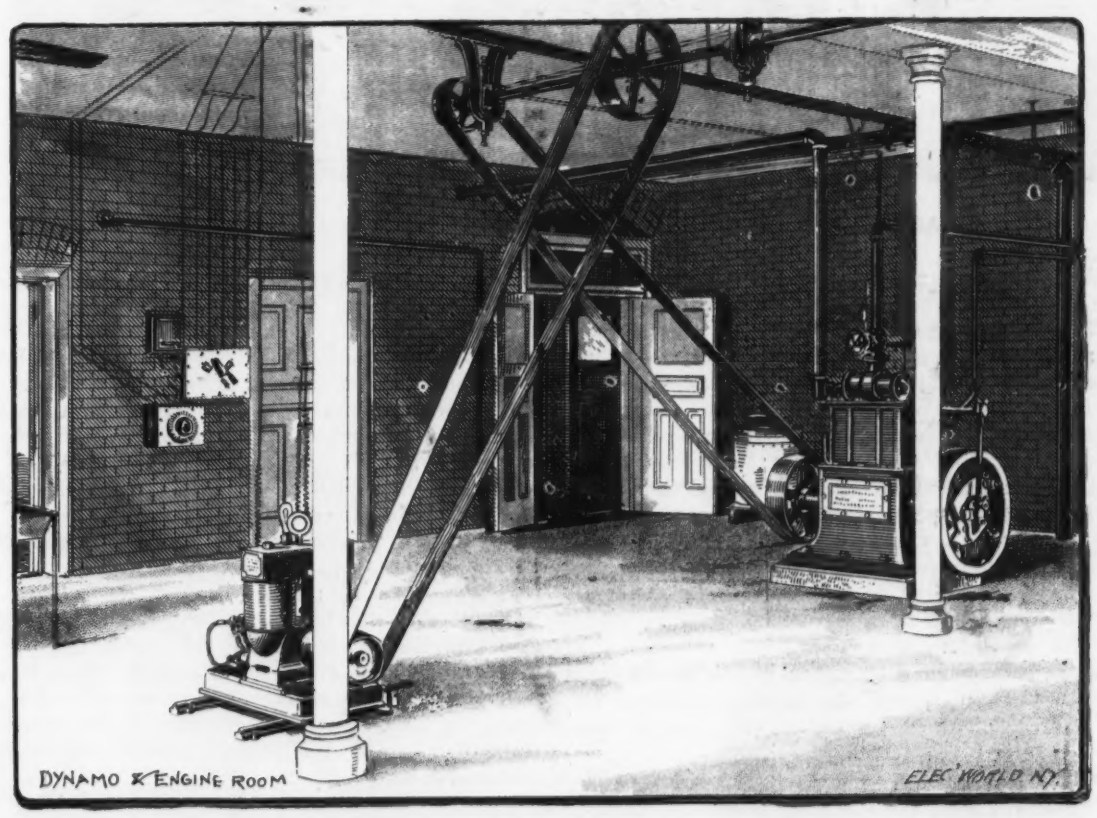


FIG. 2.—ANN ARBOR LABORATORY—DYNAMO ROOM.

Methods to Determine the Equivalent Area of Armatures.

BY ERVIN S. FERRY.

In many calculations upon the dynamo, it is necessary to know the strength of the magnetic field in which the armature revolves, or, in other words, the number of lines of force that traverse the armature during its rotation. The most convenient way to determine this strength of field of the dynamo is to find what is called the "equivalent area of the armature." By the equivalent area of a coil of wire is meant its capacity for cutting lines of force in a given magnetic field. The area is proportional to the size of the coil, and to the intensity of the magnetic field in which it revolves.

The simplest and perhaps the least accurate method to determine the number of lines of force traversing an armature is to take S. P. Thompson's new equation of the dynamo,

$$E = n\,C\,N;$$

when E is the total E. M. F. generated, n is the number of revolutions per second of the armature; C, the number of conductors on the armature, and N the number of lines of force traversing the armature. Then equating for N we get

$$N = \frac{E}{nC};$$

where n and C are known. But the difficulty lies in the fact that E cannot be easily determined accurately. It may be determined approximately if the following conditions are made good. Separately excite the pole-pieces to the same degree as when the dynamo is running under its normal conditions, then observe the voltage at the brushes. Then substituting this E in the previous equation, we should obtain N.

But there are two strong objections to this method. First, it is very difficult to attain the same degree of magnetization of the poles by separate excitation as when the machine is running normally with part of the current generated being absorbed in the magnetization of the poles. Second, no account is taken of the E. M. F. lost internally by heating and Foucault currents.

Another way to find N, also suggested by S. P. Thompson, is to wind a single turn of insulated wire around the armature, parallel to the conductors, placed in the line of commutation of the armature, and then magnetize the pole-pieces by some external current to an amount equal to its normal value. On making and breaking the exciting current, E. M. F. is generated in the turn upon the armature, which may be measured by a ballistic galvanometer. This E. M. F. is proportional to the number of lines of force transversing the coil. Now, to determine the number of these lines of force, we take a coil of wire of known geometrical area, revolve it in a magnetic field whose intensity is known, and compare the deflection due to the E. M. F. generated by this standard coil to that from the turn around the armature.

Then if N equals the number of lines of force passing between dynamo poles; N', the number cut by revolving the standard coil; d_1, the galvanometer deflection due to the single turn; and d_2, the deflection due to the revolution of the standard coil,

$$N : N' :: d_1 : d_2.$$

Or, since the equivalent area is proportional to the number of lines of force in the two fields,

$$A : A' :: d_1 : d_2.$$

By revolving the standard coil in the field of the horizontal component of the earth's magnetism, we know the number of lines of force cut by the coil to be equal to its geometrical area in centimetres times .184. This product is the equivalent area of the coil. Substituting this value for A', and the observed deflections d_1 and d_2, we get the equivalent area of the turn around the armature. If the number of lines of force is desired, divide this equivalent area of the turn by its geometrical area, and we have the number of lines of force per unit of area.

We now see that we may define "equivalent area" as *the geometrical area multiplied by the number of lines of force passing through this area per unit of area.* This method of determining the equivalent area of the armature, however, is open to two faults, first, the difficulty of separately exciting the poles to a degree equal to their normal magnetism when the machine is running; second, the value thus obtained is the area of the armature only when the dynamo is at rest.

The next method to determine the equivalent area of armatures is called for brevity the method of "floppages." There are two ways in which this method may be applied:

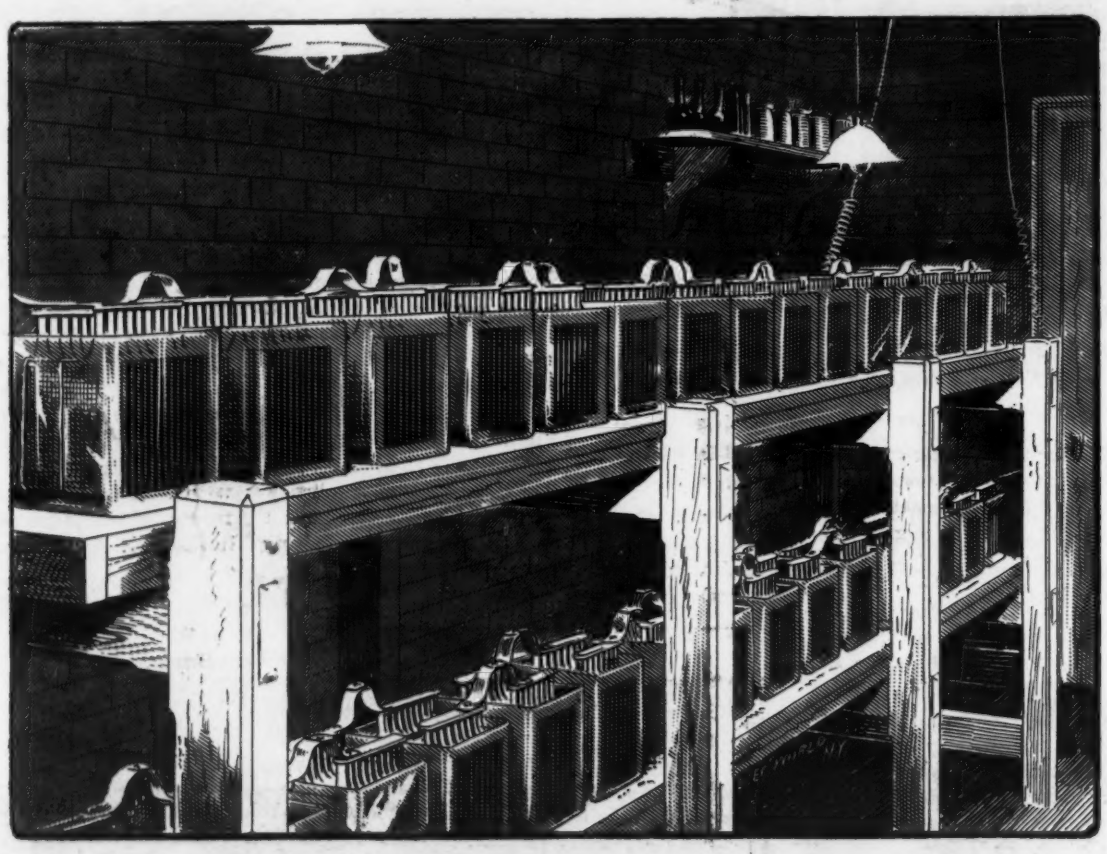


FIG. 3.—ANN ARBOR ELECTRICAL LABORATORY—STORAGE BATTERY ROOM.

the method of constant resistance and variable deflection, and the method of constant deflection and variable resistance. The modus operandi of the former method is as follows: The armature is mounted upon a cradle so that it can be revolved through some convenient angle in the earth's field. Then the brushes of the armature, the standard coil, and a delicate ballistic galvanometer are all connected in series. Now, alternately revolve the armature and the standard coil through the same angle, and if the galvanometer deflections from the coil and the armature are due to a rotation in the same component of the earth's magnetism, then these deflections are proportional to the equivalent areas of the coil or armature producing them. So that we have as before:

$$A : A^1 :: d_1 : d_2.$$

By revolving both coil and armature in the known field of the horizontal component of the earth's magnetism, the number of lines of force cut by the armature may be determined as in the previous method.

In the method of constant deflection and variable resistance, the armature and the coil are separately connected to the galvanometer with an accurate resistance box in each circuit. This connection is best done by means of a six-way switch, thereby using the same resistance box in both circuits. By this arrangement we can control the respective deflections from the armature and the coil by inserting resistance in the respective circuits, so that we can get the deflection from the coil and the armature equal. Then the areas are proportional to the resistance in circuit, or

$$A : [A'] :: R : R'.$$

These two methods of floppages give the same area. It makes a difference in the area found by these methods of floppages, whether the armature is pointing north and south, or east and west. The reason is that the shape of a single armature coil is oblong instead of circular. From the direction of the magnetic dip we see that a horizontal circular coil will always contain the same number of lines of force in whatever direction it is placed, with respect to the points of the compass. We also see that in the case of an oblong coil this is not so. If its longer axis is placed north and south it will contain a certain number of lines of force; but if the longer axis is placed east and west the coil will contain a greater number of lines of force. The reason of this is that the lines of force are evenly distributed parallel to the dip, so that on cutting a horizontal plane they are nearer together in the east and west direction than in the north and south direction.

In our experiments on this point with an armature of the Thomson-Houston incandescent type, it was found that the equivalent area of the armature, when north and south, was 73,024 square centimetres, while the area, when armature pointed east and west, was 73,825 square centimetres.

The method of floppages is open to some serious objections, among which may be noted, first, the area found is not the area when under working conditions, when the machine is running and when various heating and Foucault effects occur that do not occur when the armature is still. Second, the area thus found is an incorrect value, even for a motionless armature. The reason of this is not far to seek. The great mass of iron core inside the armature coils attracts into the armature more lines of force than would pass through the armature were there no iron in it. The standard coil has no iron in its construction, so that the ratio really is

$$d : d^1 :: A : A' + k;$$

where k is a constant that cannot be directly determined, depending upon the mass and the purity of the armature core.

Having now studied the errors and imperfections of these methods, it remains to describe a method by which they can be almost entirely avoided. If we wind a turn of fine, insulated wire around the armature, parallel to the conductors terminating at a two-part commutator, we can compare the E. M. F. generated by this coil to that generated by the armature, when the armature is running under normal conditions. As the geometrical area of this turn is known, we can find the equivalent area of the armature by the ratio,

$$A : A' :: d^1 : d^2.$$

The equivalent area of the same armature as used in the former experiments was found by this method to be 59,229 square centimetres. This result is much less than that obtained by the previous methods, as was expected before this method was tried. From this disparity in the two determinations we perceive the great effect the iron core exerts in the method of floppages. By this method of the coil around the armature the area obtained is a value in which all the conditions of a machine in normal operation are accounted for, such as heating and Foucault effects. Again, there are fewer mechanical and technical difficulties to be overcome in this method than in any of the others investigated.

This difference is well brought out when we consider the difference in the voltage dealt with in the various methods. The voltage given by revolving the standard coil was determined to be 0.0015 volts. The galvanometer employed was so delicately adjusted that this 0.0015 volts gave a deflection of 355 millimetre, and as deflections could be accurately read to one millimetre, the galvanometer was sensitive to a change of potential of 0.000,004,32 volts. The E. M. F. generated by revolving the armature in the earth's field was 0.00056 volts. In comparison with the extreme sensitiveness of galvanometer needed in the method of floppages with that required in the method of coil around armature, we find that in the latter case the voltages obtained from the armature and the coil around the armature were 143.26 volts and 5.141 volts respectively.

The Difficulties of Utilizing Niagara.

To the Editors of The Electrical World:

In reference to the wasting forces at Niagara, I would suggest that the difficulty of erecting a machine or plant to utilize this great force to any extent appears in the many plans suggested to consist chiefly in building one that will not be worn out or washed away in the time required to repair it.

The idea of having all working parts under water suggested by Mr. L. H. Hallam is worth consideration, as all experienced in melting the ice which forms around gate stems can testify. But the 6 × 12-foot paddles, as they flop over the drum uppermost in the stream and open more quickly than the water flows, make it nece arily very troublesome to maintain such an arrangem nt. A plan which seems more feasible, and which Mr. Hallam could adopt in connection with his arrangement, is to sink a conical cylinder in the stream, in the apex of which a turbine water wheel should be placed. Two such could be placed, one on either side of his sunken room, and the combined forces of their streams thrown upon one wheel. Of course, the object of making the cylinders conical is to gain rather than lose force, and it is unnecessary to speak of details.

PHILADELPHIA. T. YEARSLEY.

The Author of "Electron."

To the Editors of The Electrical World:

I think I can identify the author of "Electron," mentioned in your last issue, with W. C. Richards, A.M., a well-known scientific man, who is still, I believe, lecturing in some part of this country. He has written several books, the most familiar being "Harry's Vacation," a series of experiments in and essays on general philosophy. If I mistake not, Dr Richards was one of the first, if not the first, to introduce Geissler tubes into this country. It would not be at all unlikely that he should write a book of poems on electricity. G. P. T.

NEW YORK CITY.

Two-Wire and Three-Wire Systems.

To the Editors of The Electrical World:

Would you inform me through your columns of the comparative amount of wire used on the two and three-wire multiple arc system, for the same number of lamps at the same voltage, and loss at the same distance from the station in each case? A. A. N.

NEENAH, Wis.

We would refer you to the exhaustive paper on this subject, by Mr. W. J. Jenks, published in THE ELECTRICAL WORLD of July 20, 1889.—EDS E. W.

Making Storage Battery Plates.

To the Editors of The Electrical World:

Will you please tell me what the red lead and litharge is mixed with before being put in the plates of a storage battery? I have been using clear acid, but find it takes too much time to mix it, as it burns unless great care is taken. Is there not something else used besides clear acid? By answering you will greatly oblige

BRADFORD, Pa. J. H. R.

ANSWER.—In pasting the plates, those intended for positives should be pasted with red led and sulphuric acid and the negatives with litharge and sulphuric acid, or water may be employed with the latter, but the paste thus made would not be so coherent. The judicious addition of water in both cases would probably help you.—EDS. E. W.

Questions as to Motor Construction.

To the Editors of The Electrical World:

(1) If I desire to construct a ⅛ h. p. electric motor, what is the formula to follow to obtain that efficiency?

(2) What is the objection to armatures made of spools or bobbins, that they are not more generally used?

(3) In driving a ⅛ h. p. motor (gramme-ring type) that is wound for a 20-ampère current, as a dynamo, why do I fail to generate any perceptible current?

PROVIDENCE, R. I. A. B. CARPENTER.

ANSWER.—(1) One-eighth h. p. is about 93 watts or volt-ampères. Assuming a total loss of 25 per cent., a motor to develop this power, would require to be supplied with 116 watts, which, for example, on a 110-volt incandescent circuit is approximately one ampère. The motor must therefore be so wound as to produce a counter electromotive force as nearly as possible equal to this when running at any convenient speed, the difference between the two depending on the loss in the motor resistance.

(2) Presumably on account of heating and Foucault currents produced in iron cores, especially if the field is a complex one of varying strength or opposite sign, in which the motion is one of translation; also on account of less rotary effort and more complicated construction.

(3) Small motors when run as dynamos, often fail to excite themselves on account of the relatively high magnetic resistance of the air-space between pole-pieces and armature core. The speed also would need to be excessive.—EDS. E. W.

Successful Electric Street Railways.

There is hardly any class of men in the country, who, according to appearances at least, are more satisfied with life than the managers of electric street railways. It is very gratifying to the electrical fraternity that this is so, and it is quite interesting to read the complacent letters of the different managers of street railways, and note their tone.

A gentleman in one of the Western cities, being interested to know exactly what was the state of feeling among the managers of some of the street railways operated by electricity in this country, recently sent a telegram to a number of the presidents of the prominent roads, asking in regard to the manner in which they regarded their system. The roads chosen were the Cincinnati Inclined Plane Railway, the Scranton People's Railway, the Bay Ridge, Maryland, Electric Railway,the East Cleveland Street Railway, the Asheville Electric Street Railway, the St. Joseph Union Passenger Railway, the Erie Passenger Street Railway, the Davenport Central Railway. In each case a most satisfactory reply was received, and in more than one instance the repsonse was highly enthusiastic. Such a test tells its own story.

The Electric Subways of Paris.

At the close of 1888, the Municipal Council of Paris granted concessions for electric lighting in various quarters of Paris to the Edison, Popp, Sencier, Surry-Montaut and other companies, reserving to itself the right to put in a central station of its own at the Halles market.

Operating under these privileges, the first three companies have put in underground conduits, the types of which are shown in Figs. 1 to 4, taken from an article by M. Laffarque in *La Nature*. These subways are built of cement, sand and lime mixed, in which small ducts or troughs are made, above which is a bed of sand, on which rests the granite blocks or the asphalt of the roadway. All these conduits are not less than 1.20 metres from the houses, the municipality reserving the right to building immediately next to the houses. The methods of construction and of crossing streets, road beds, etc., are common to all the companies. In some little-frequented streets the conduits are only 1.50 metres below the surface; in others the cables are simply laid with a lead casing, but in the leading thoroughfares some of the conduits are as deep as 7.40 m., and they are connected together by subterranean galleries. Fig. 5 shows a subway of this kind 7.40 m. deep, with a species of man-hole near the houses .80 m. in diameter. In the lower part of this is a subterranean gallery 1.50 m. in height. To descend these small manholes iron ladders are used, such as are placed in sewers. Finally, from point to point are located large manholes of the kind shown in Fig. 6.

The conduits having thus been made, the conductors were placed in them. The Edison Company places its cables, of bare silicon bronze wire, on brackets of galvanized iron, carried by porcelain insulators, Fig. 1. These in turn are supported by iron rods fastened to an iron cross support, secured in the masonry at the bottom of the conduit. The cables are held fast by the metal clips. The same method of using bare conductors has been adopted by the company for the transmission of power, as shown in Fig. 2. For taps along the streets the company has employed lead cables in wooden moldings treated with sulphate of copper. The Compagnié Parisienne d'Air Comprimé uses the method shown in Fig. 3, with iron tubes 20 centimetres in diameter, in which the wires and cables are placed haphazard. The service of the Municipality is shown in Fig. 4, where the conductors are seen held up by hooks of vitrified iron inserted in the wooden linings. This plan allows a number of conductors to be placed in a limited space.

In order to draw in the cables, the Edison and Electric Power Companies unwind off large drums, as shown in Fig. 6. The Popp Company, on the other hand, leave a small wire in their pipes, and to this wire the end of a cable is attached, so that it may be pulled through. Such a method results in many abrasions, leading to leaks, short circuits, etc., which is specially undesirable where a number of conductors lie together indiscriminately.

The Popp Company is furnishing 44 Thomson-Houston arcs from a dynamo driven by a 50 h. p. compressed-air motor. The Edison Company is running a large number of incandescents at 110 volts, and has a number of arcs.

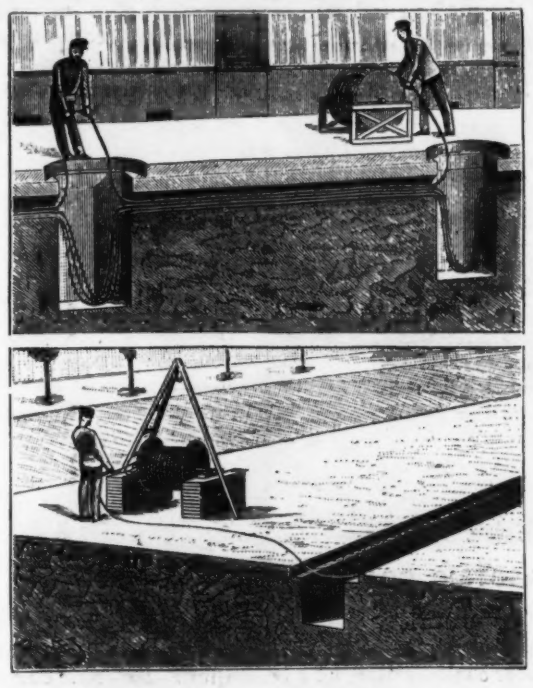


FIG. 6.—PUTTING CONDUCTORS IN THE NEW PARIS SUBWAYS.

The Electric Power Company is supplying 25 arcs, and the Municipal service will use the Edison system for continuous current work and Ferranti apparatus for alternating current work.

The Inspection of Stations and Circuits.

BY M. D. LAW.

I see that the subject of inspection of electric light plants has had some notice through these columns, and I wish to lend my a'd to the agitation.

There is certainly a great need of good, competent inspectors, not only for electric light stations but outside work as well. Within the last week I have seen a man, who should know better, running wires for an arc lamp and fastening them to the walls and ceilings, with one-inch iron staples. The wires were to be used as a loop for a two-thousand candle arc lamp, and were run not over one inch apart.

I hope the time will soon come when there will be a system similar to that of the New England Exchange adopted throughout the United States. Still that will not meet the demand without good reliable inspectors, as I can name one man in our city who would pass a good examination before the New England Exchange, and still he has made his brag that he put in a twenty-five ampère fuse, when a ten ampère fuse would do, but that he was not going to be troubled by its going off. This is a very common fault, and should be greatly condemned.

Another good reform for the insurance companies to take up would be to demand that all buil lings should be wired for not greater than a 30-volt potential. As contracts are let to wire buildings for a 150-volt potential at a 5 or 10 per cent. loss, and then 90 or 100, sometimes as low as 30, volt lamps are used on that wiring, it does not take a very long head to tell where the trouble is coming. I have in mind now a building that is thus wired, there being six volts fall of potential from front to back of the building. The owners of the building own the wires, and they will allow no change, so the only help in such a case is through the insurance companies, who should have some standard, and compel all wiring to come to that standard.

I am fully in accord with Mr. Alexander, in his report at the Niagara Falls Convention, that a system of examining boards be formed, which will issue certificates to men seeking positions in the electric light service, and that these certificates shall be forfeited if it is found that such men are known to violate the ordinary rules of electric light construction. It seems to me that if this is carefully carried out, a high standard of work may be gained, and the fire risk very much lowered.

Coal Consumption for Arc Lights at Little Rock, Ark

Mr. W. H, Hinkle, the engineer and superintendent of the city electric light plant, at Little Rock, Ark., writes us as follows:

In your issue of Aug. 10 I see a statement from "W. E. S." in regard to the amount of coal consumed in running a 1,000-light incandescent plant, lamps of 16 c. p. each. You say that you would be glad to hear from others on this subject, so for the benefit of some of your readers, as to the cost of fuel to run an arc plant, I will here give you a copy of the expense sheet for running a 111 arc light plant, of 2,000 c. p. each, for lighting the streets of the city of Little Rock, Ark., for the month of July. The plant was run 178 hours during the month, always keeping the fires banked so as to be ready to put on the lights at any hour of the night:

Monthly pay-roll for all labor	$270.00
Oil, waste and packing	10 25
Carbons	22.00
38 tons lump coal, $2.75 per ton	104.50
2 broken globes, 35c. each	.70
General repairs	12.00
Total cost one month	$419.45

We have 26 miles of wire, 111 double arc lamps, of 2,000 c. p. each, four 30-light Fort Wayne Jenney dynamos, one 16 inches by 42 inches Hamilton Corliss engine, running 106 revolutions per minute, cutting off at one-fifth stroke, carrying 90 to 100 pounds of steam on the boiler. We have two return tubular boilers, 48 inches diameter, 16 feet long.

Now, dividing 76,000 pounds of coal by 178 hours, gives 436 pounds coal per hour, or nearly 4 pounds per hour for each light.

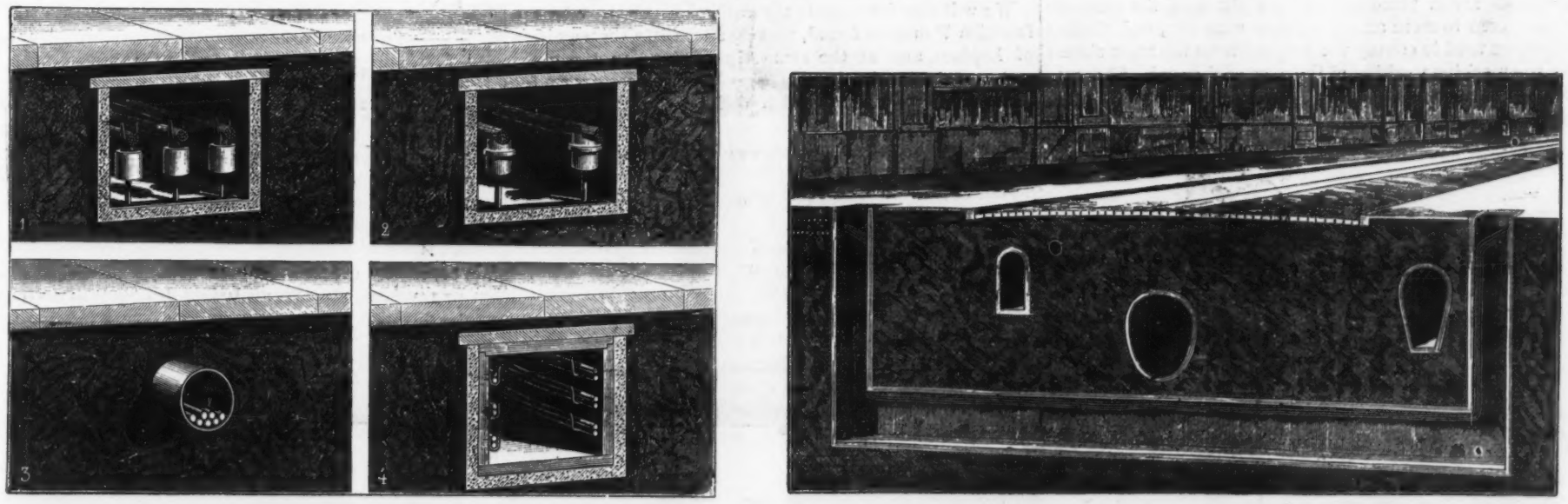
A 2,200-Volt Shock.

BY L. S. DAY, LOUISVILLE, KY.

On the evening of July 31 my dynamo attendant, Mr. Daniel I. Phelps, was testing a Brush arc lamp, 2,000 c. p., which was in the circuit with 44 other lamps, said circuit and lamps being supplied by a Brush No. 8 dynamo. One of the wires became loose in the binding post of the lamp, and in his endeavor to secure it firmly it slipped from the binding post; and as he held the wire in one hand and the binding post in the other, he was put directly in the circuit with the lamps, which had a voltage of at least 2,200 volts, the station ammeter showing 9.1 ampères at the time.

Mr. Phelps was thrown to the floor, but did not lose consciousness until he had raised his head from the floor to see if he was clear of the wires. He was then unconscious for two hours and twenty minutes. Bleeding at the arm and the application of a graduated Faradic current were the means used for resuscitation. Mr. Phelps is fully recovered, aside from the severe burns which he received on one hand—the one by which he held the wire—all the fingers being burned to the bone.

Can it be explained how he should receive such severe burns as he did upon his tongue? The whole top surface and the edges were burned, so that large blisters were



FIGS. 1, 2, 3, 4 AND 5.—THE NEW ELECTRICAL SUBWAYS OF PARIS, FRANCE.

formed, and yet there were no contacts made with the circuit but with the two hands. As superintendent of the station here I have brought this striking incident to the notice of the Executive Committee of the National Electric Light Association.

The Latest Form of Sperry Electric Coal Cutter.

We have several times had occasion to refer to the coal cutters or "diggers" manufactured by the Sperry Electric Mining Machine Company, and it is with pleasure that we now show the latest form of these devices in Figs. 1 and 2. Both these styles of machine are in operation in the No. 1 shaft of the Chicago, Wilmington & Vermillion Coal Company, at Streator, Ill. This mine is one of the oldest in the State, having been worked for the past twenty years. The vein is 5 feet thick and the mining is done in the coal which along the bottom of the vein is full of sulphur balls, making the mining exceedingly difficult, in fact, so much so, that heretofore the superintendent deemed machine mining out of the question.

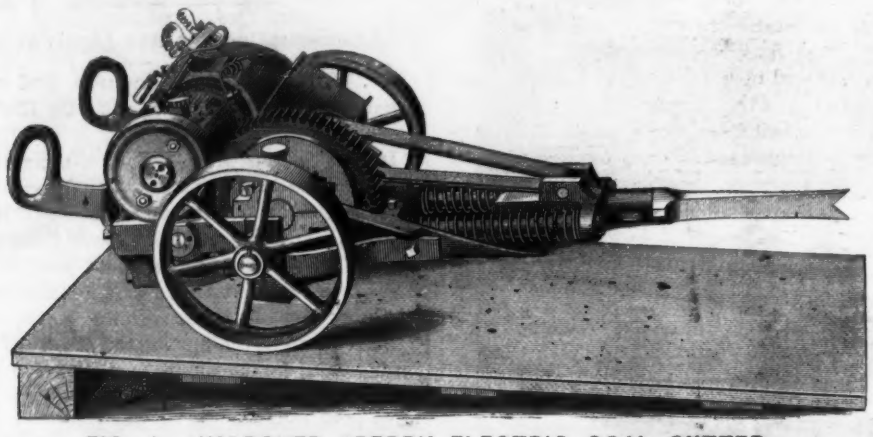


FIG. 1.—IMPROVED SPERRY ELECTRIC COAL CUTTER.

The Sperry coal cutter represented in Fig. 1 is working daily and cutting from 5 to 8 feet an hour under the unfavorable conditions above mentioned. On account of the coal having been taken out near the shaft the machine is compelled to work 4,000 feet from the dynamo stationed in the machine shop on the surface, which is a striking example of the practicability of long distance transmission of power by electricity in mines. A circuit of 8,000 feet of No. 5 well-insulated wire is in the mine, that insulation being proved the best which does not absorb moisture but allows it to stand out in beads on the wire. A ten-light dynamo of the improved Sperry pattern takes power from the engine in the machine shop. The wires are run down the shaft and through the entries to the rooms being worked. They are strung on one side of the main entry of the mine near the top, cleats being used to fasten the wires to the props. Switches are in place to facilitate changing the machine from room to room as is necessary each day, and flexible wires are used to convey the current from the main circuit to the machine working at the face of the coal. The machine is undercutting 4 feet and it can be increased to 5 feet if desired. It is operated by a 25-ampère current with a voltage of 98. The company have near completion twelve machines, ten of which will be installed at Streator, a 30 h. p. constant potential dynamo furnishing the power. They also will make installations as rapidly as possible at Kewanee, Ill., Brazil, Ind., and Victoria, B. C., plants having been ordered for the mines at these places.

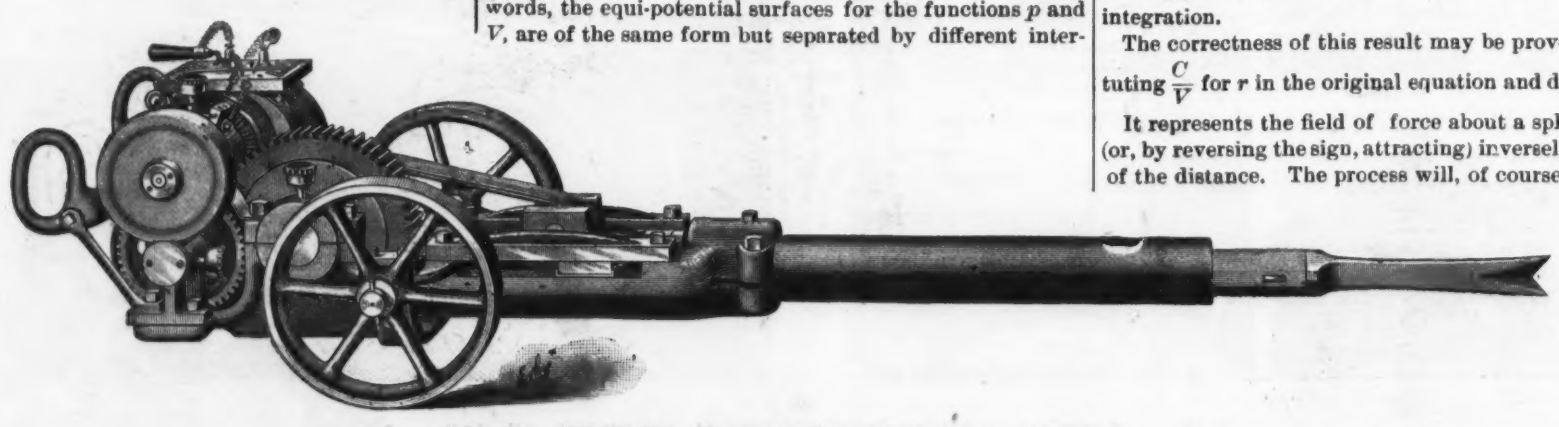


FIG. 2.—IMPROVED SPERRY ELECTRIC COAL CUTTER.

Fig 2 represents a small machine also working at Streator, 4½ feet long, and with a 3-foot undercut. It is intended for thin veins where long wall work is the rule, and the distance between the props and the face of the coal is not such as to admit of using a longer or larger machine. In construction it is practically the same as the standard machine, and the mechanism of both has been described in a former issue of the WORLD.

The Sperry system for mines includes haulage and drilling, as well as ventilation and lighting, but at present the attention of the inventor is mainly directed to the building of the coal cutters, as the demand is great, and the work they do is the basis of all that follows.

Potential Geometry.

BY TOWNSEND WOLCOTT.

In THE ELECTRICAL WORLD for July 21 and Aug. 4, 1888, was published under the above heading a method for finding a set of curves or surfaces which will intersect a given set orthogonally. Such an orthogonal system will truly represent a field of force under certain supposable conditions, which, however, may not be the conditions it is desired to impose. This paper is a further investigation of the subject, and the demonstration of a method for finding a potential function fulfilling the required conditions, if such a function exist.

In the fields of force due to gravity, magnetism and statically electrified conductors, where free space alone is under consideration, and in the flow of electric currents, there is a condition that the potential V shall satisfy the equation of Laplace $\frac{d^2V}{dx^2} + \frac{d^2V}{dy^2} + \frac{d^2V}{dz^2} = 0$, (Maxwell, art. 77, Thomson and Tait's Natural Philosophy, etc.). In electro-statics we may have a density ρ within the mass of an electrified dielectric (called volume density, to distinguish it from the surface density, σ), in gravity we have a density within the attracting mass, and in magnetism within the iron or other magnetic substance there is also a volume density. In these cases the last equation becomes $\frac{d^2V}{dx^2} + \frac{d^2V}{dy^2} + \frac{d^2V}{dz^2} + 4\pi\rho = 0$, and is called the equation of Poisson. These equations are sometimes written for brevity, $-\triangle^2 V = 0$ and $-\triangle^2 V = -4\pi\rho$ (the symbol $-\triangle^2$, which indicates the operations to be performed in the first member, is called Laplace's operator). If, p being the parameter, $-\triangle^2 p$ is not $= 0$, then the system can only represent a field of force in which the density $\rho = \frac{\triangle^2 p}{4\pi}$, for free space is space which contains no matter, etc., and the density is, of course, everywhere 0.

We will now investigate the conditions under which a function V may be found, that shall satisfy the equation of Laplace, and at the same time belong to the given orthogonal system. In this case the surfaces drawn for values of p = constant, which differ by a constant difference, will not belong to values of V which differ by a constant difference, but are otherwise correct. In other words, the equi-potential surfaces for the functions p and V, are of the same form but separated by different intervals, where the intervals represent equal differences of potential.

The parameter p is a function of the three independent variables x, y and z. Now any other parameter P, is also a function of x, y and z, and consequently more or less implicitly or indirectly a function of p, and it is on this principle that we have deduced the method for finding a set of curves or surfaces orthogonal to a given set. But between p and V there is a more direct relation, for by hypothesis, V is constant for any surface for which p is constant, hence V is a function of p and constants independently of x, y and z.

To make this matter perfectly clear, suppose the value of V for one surface is V_1, and the value of p for this surface is p_1. Now if we pass to another surface V_2 for which the value of p is p_2, the result will be the same whether we have passed from one surface to the other in the direction of x, of y, of z, or in any other path whatever. If we denote by $d_x V$ the partial differential of V when x alone varies, and by similar notation the y and z differentials, we have from the relation just stated

$$\frac{d\,V}{d\,p} = \frac{d_x\,V}{d_x\,p} = \frac{d_y\,V}{d_y\,p} = \frac{d_z\,V}{d_z\,p}$$

and similarly for the succeeding derivatives, so that the subscript letters may be omitted.

By the most general hypothesis that V is a potential function of any kind $\frac{d^2V}{dx^2} + \frac{d^2V}{dy^2} + \frac{d^2V}{dz^2} = -4\pi\rho$; and by the well-known rule of the differential calculus $\frac{dV}{dx} = \frac{dV}{dp}\frac{dp}{dx}$; and also differentiating again,

$$\frac{d^2V}{dx^2} = \frac{d^2V}{dp^2}\left(\frac{dp}{dx}\right)^2 + \frac{dV}{dx}\frac{d^2p}{dx^2}.$$

Writing the corresponding expressions involving y and z and adding we have,

$$\frac{d^2V}{dp^2}\left(\frac{dp^2}{dx^2} + \frac{dp^2}{dy^2} + \frac{dp^2}{dz^2}\right) + \frac{dV}{dp}\left(\frac{d^2p}{dx^2} + \frac{d^2p}{dy^2} + \frac{d^2p}{dz^2}\right) = 4\pi\rho,$$

the second integral of which is the value of V in terms of p.

If we write X, Y and Z for the components of the force in the directions of x, y and z respectively for the potential V, R for their resultant, X', Y', Z' and R' for the corresponding quantities for p, also ρ' for the density for p, the last equation may be written,

$$\frac{d^2V}{dp^2}(X'^2 + Y'^2 + Z'^2) - \frac{dV}{dp}\left(\frac{dX'}{dx} + \frac{dY'}{dy} + \frac{dZ'}{dz}\right) = -4\pi\rho;$$

or still more briefly $\frac{d^2V}{dp^2}R'^2 - \frac{dV}{dp}4\pi\rho' = -4\pi\rho$. It should be borne in mind that the sign of the potential is so chosen that the potential at any point and the potential energy due to a unit of electricity, etc., at that point shall have the same sign. These two quantities are numerically equal, but in order that their signs should be alike, the force in the direction of say x must be $X = \frac{-dV}{dx}$ and not $X = \frac{dV}{dx}$.

We will not now consider this general form of the equation, but only that where $\rho = 0$, which is always integrable. In order that this form may be true, it is evidently necessary that R' should be a function of ρ' independently of x, y and z, or, at least these letters must enter, if at all, in such a manner that they may be cancelled out, or otherwise V could not be a function of p independently of x, y and z, which it is by hypothesis. Let us take an example: Suppose we had obtained the equation $r^2 = x^2 + y^2 + z^2$, a set of concentric spherical surfaces, with r for variable parameter. Here we have

$$\frac{dr}{dx} = \frac{x}{r}, \quad \frac{d^2r}{dx^2} = \frac{1}{r} - \frac{x^2}{r^3},$$

and the derivatives for y and z are obtained by substituting these letters respectively for x. This gives

$$\frac{d^2V}{dr^2} + \frac{dV}{dr}\frac{2}{r} = 0.$$

Here r could only be the potential on the supposition that we have a distribution of electricity, etc., with a density of $-\frac{1}{2\pi r}$, in which case the resultant force would be constant and of unit magnitude.

This equation is satisfied by making $V = \frac{C}{r}$, in which case, $\frac{dV}{dr} = -\frac{C}{r^2}$, and $\frac{d^2V}{dr^2} = \frac{2C}{r^3}$, C being a constant of integration.

The correctness of this result may be proved by substituting $\frac{C}{V}$ for r in the original equation and differentiating.

It represents the field of force about a sphere, repelling (or, by reversing the sign, attracting) inversely as the square of the distance. The process will, of course, apply to two dimensions, by omitting the derivatives, with respect to one co-ordinate. Thus, if the radii in Fig. 2 (first paper) are equipotential lines, and the circles lines of force, we have

$$y = a\,x, \quad \frac{da}{dy} = \frac{1}{x}, \quad \frac{d^2a}{dy^2} = 0, \quad \frac{da}{dx} = -\frac{a}{x} \text{ and } \frac{d^2a}{dx^2} = \frac{2a}{x^2}.$$

The equation of Laplace now becomes, by cancelling the common denominator x^2, $\frac{d^2V}{da^2}(1 + a^2) + \frac{dV}{da}2a - 0$. The first integral of this is

$$\frac{dV}{da} = \frac{1}{1 + a^2}, \text{ whence } \frac{d^2V}{da} = -\frac{2a}{(1 + a^2)^2},$$

and the second integral is $V = \tan^{-1}a$. This represents the field of magnetic force about an infinite straight conductor, and as $a = \frac{y}{x}$, it agrees with the equation given by Maxwell, Art. 480, with the exception of the constants $2i$ (i being the current strength), and C (a constant of integration). This is as it should be, as our method is only in-

tended to determine the form of potential function belonging to a given set of curves or surfaces, its absolute magnitude depending on particular conditions, which may be assumed at pleasure. Maxwell's result is deduced from two experiments, one showing that the resultant force is inversely as the distance from the conductor, and the other that it is proportional to the current. Our result is a direct deduction from Oersted's experiment: that the

FIGS. 1 AND 2.—MIX AND GENEST TELEPHONE APPARATUS.

lines of force are concentric circles with the conductor axially situated thereto.

We may also introduce the constant $2i$ by adopting the relation between magnetic force and current strength and by assuming a particular radius as being at zero potential we introduce the constant C. Oersted's experiment may not be capable of quite such a degree of accuracy as a zero method like that given by Maxwell, but

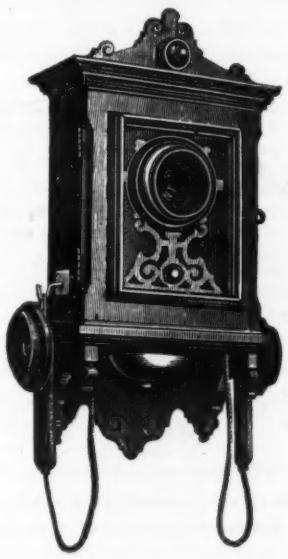


FIG. 3.

on the other hand, as Oersted's experiment is assumed in this investigation, the result deduced from Oersted's experiment direct has an interest of its own.

In this paper the form of the potential function is deduced from the direction of the force when this is known for every point of the field. In the usual method the potential function is obtained from the intensity of the force at every point. If the radii Fig. 2, first paper, are

FIG. 4.

lines of force, and the circles equipotential lines, we have the equation of Laplace $\frac{d^2 V}{d r^2} + \frac{d V}{d r}\frac{1}{r} = 0$ of which the first integral is $\frac{dV}{dr} = \frac{C}{r}$, and the second $V = C \log_\varepsilon r$. This represents the field of electric force about an infinite cylindrical conductor with a static charge. It also represents the flow of current in a cylinder which is held between two cylindrical electrodes, one internal, the other external.

If we take the equation $y^n = n\,p\,x$, $\frac{d\,p}{d\,x} = \frac{-p}{x} = \frac{-n p^2}{y^n}$, $\frac{d^2 p}{d\,x^2} = \frac{2\,p}{x^2} = \frac{2 n^2 p^2}{y^{2n}}$, $\frac{d\,p}{d\,y} = \frac{y^n}{x} = \frac{n\,p}{y}$, $\frac{d^2 p}{d\,y^2} = \frac{n^2 p - n\,p}{y^2}$; hence $R'^2 = \frac{n^2 p^4}{y^{2n}} + \frac{n^2 p^2}{y^2}$ and $-\nabla^2 p = \frac{2 n^2 p^2}{y^{2n}} + \frac{n^2 p}{y^2} \frac{-n\,p}{}$ We may multiply both expressions by $\frac{y^{2n}}{n^2 p^2}$, which gives us $p^2 + y^{2n-2}$ and $\frac{(n-1)\ y^{2n-2}}{n\,p} + 2p$.

If $n = 1$, these expressions reduce to $p^2 + 1$ and $2\,p$, which give an equation which has just been solved.

When, however, n differs from 1, y cannot be cancelled out, and the curves represented by the equation $y^n = n\,p\,x$ cannot belong to a field of force in free space.

Mix and Genest Telephonic Apparatus.

We illustrate on this page some of the newest telephonic apparatus of Mix & Genest, of Berlin, Germany, to whom we are indebted for the details. As will be seen, it has been the special study of these makers to construct telephones easy and handy to use; and in some of the apparatus great ingenuity is displayed. Fig. 1 shows the "Löffel" or "spoon" telephone, so called from its peculiar shape. The receiver consists of a diaphragm and horse-shoe magnet

FIG. 5.

provided with a worm or screw gearing, by which the distance between the magnet core and the diaphragm is adjusted. The method of holding the regulator is as follows: A piece about 1 cm. in length is cut out of the screw attached to the back of the magnet, and replaced by a like threaded piece. This is bored parallel to the axis of the screw and in it an extended conical shaft eccentric to the screw is inserted, in such a manner that the further the screw enters the more firmly the loose piece is jammed or pushed against its nut; and so both parts are firmly clamped or locked together. Fig. 2 shows this apparatus as put together for ordinary use attached to the wall of the office or room.

But as everybody knows, it is not always convenient to get up from one's chair or desk to use the wall telephone. Mix & Genest have therefore devised a portable telephone of specially attractive form, embodying the combination

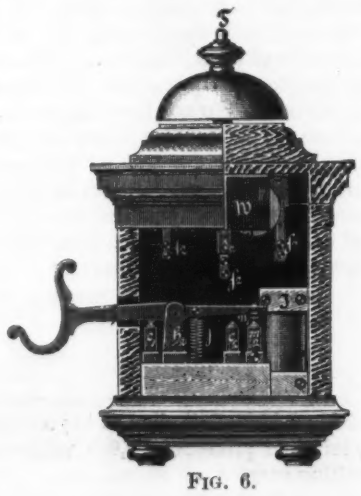


FIG. 6.

of transmitter and receiver, shown in Fig. 3, where one of these is placed at each end of a bent metal tube. Thus, while the receiver is held to the ear, the transmitter is brought directly in front of the mouth. On the inner side of the handle is a switch or contact piece that cuts the transmitter in and out, and opens or closes the battery circuit; and in holding the telephone in the hand, the circuit is closed automatically. This apparatus is made up in different ways, as, for example, in Fig. 4, where it take the shape of a "table chest," of which sectional views are given in Figs. 5 and 6. Fig. 4 is a handsomely decorated box of chestnut wood, with bronze trimmings and feet. From the sides project two semi-circular shelves, covered with plush, etc. One of these serves to hold up the transmitter, while the handle rests upon the circuit closer H^1, which is pivoted on H^2, and either rests upon contact c^1 when not in use, or c^2 when speaking is going on, in the latter case closing the circuit of the battery through $m^1\ m^2$. A speaking apparatus having no contact piece or circuit closer may be attached to this case. The bell G has a push button T, the shaft of which passes through the bell, with interior mechanism, as shown. The bell is fastened to the cover of the box, and is so constructed that by means of two regulating screws it can be converted from a vibrating to a single stroke bell. The hinges S allow the cover to be opened, and when the box is closed, $f^2\ f^2$ serve to complete the circuit from the binding post under the cover to the flexible cord used with the telephone in the room.

Two other forms of holders or rests are shown in Figs 7, 8 and 9, these being cases which hold the telephone on a table, desk, etc., when not in use. These cases carry the push buttons, while the bell, battery, induction coil, etc., are placed near by on the wall or any piece of furniture that may offer. It will be seen that the use of the telephone is thus rendered extremely convenient, even for a

FIG. 7.

sick person lying down. This apparatus also is handsomely finished in nickel-plated iron, bronze, etc., and mounted in green plush.

Plante and the Effects of the Current.

BY E. A. LE SUEUR.

If M. Gaston Planté had lived a few months longer than he did, it is possible that he would have afforded a valuable contribution to our knowledge of the effects of a current on the average human constitution by giving to the world a more detailed account than, I believe, he has left, of an accident to himself during his experiments with the formed plates of his own invention.

It would seem from the statement which he gives that he received without fatal injury a current somewhat greater than the one which is coming to be considered sufficient for

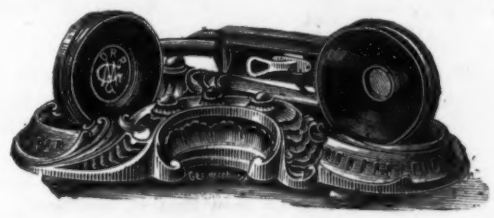


FIG. 8.

carrying out the death sentence. In the *Récherches sur l'Electricité*, he tells of accidentally making circuit through his person with 600 charged secondary cells, whose E. M. F. he speaks of elsewhere as being 2.4 volts, this giving a total potential difference of more than 1,400 volts. He describes the sensation as like a hot iron passing through his body. There were in this case no fatal effects.

Two circumstances, no doubt, combined to render the shock less effective than it would be if administered for the purpose of producing death. They are that the current was a continuous one, and that the contact resistance was in all probability a much larger proportion of the total than it would be made in the above case. It may also be claimed that the battery resistance itself played a considerable part in cutting down the current, but although

FIG. 9.

the couples in use at the time were very small, it is not probable that the resistance of the whole 600 amounted to anything like 100 ohms, so that it would really be negligible.

It appears to me that the fact of Mr. Planté's having endured a shock from a source of the power described, ought to be enough to make men of the reputation of Mr. Edison very careful about saying that an ampère of current is ten times as much as any man needs to kill him.

It may here be remarked that Mr. Edison is credited with a most extraordinary statement about the facilities offered by the electric current for "mummyizing," the statement being to the effect that an ampère current through 1,000 ohms would effect the dessication of an average man in five or six minutes; the fact being that that current for six minutes would be sufficient to boil away only half a pound of water, or to raise the temperature of an average human body four degrees Fahrenheit!

The "Five-Lead" System.*

BY DR. KREIGER.

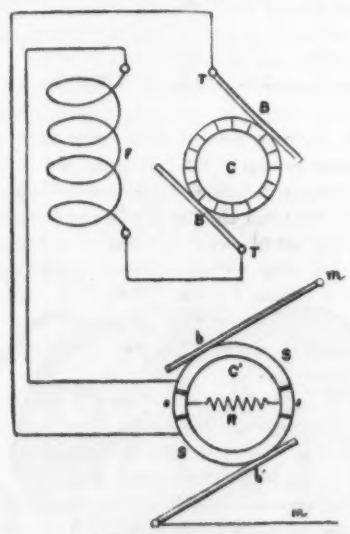
We have no sense affording direct perception of electricity. Still, although we are unable to see the play of the phenomena, the practical applications increase daily. A central station is about to be erected in Königsberg for supplying electric light and power, and the manner of doing this is full of interest. Imagine a raised tank, from which water is led through mains to a turbine, and you have an image of the electric current. The height of the water corresponds to the electric pressure above the earth, which is obtained by dynamos. In dealing with large quantities of electricity we must provide a special return lead, similarly with water, by means of a water discharge. The larger the current of electricity the larger the wires, which, with a large number of lamps, become considerable. If we desire to run a double number of turbines with the same quantity of water we must raise it to twice the height and place one turbine above another; in the same way the number of lamps is increased, without more copper, by doubling the pressure and connecting two lamps in series. To this end a third lead is placed between the two usual ones, the lamps being equally distributed on both sides, in which case each lamp will receive sufficient current.

Returning to the turbines, and supposing the number of upper ones is smaller than the lower, while each requires the same quantity of water, then the water flowing from the upper stage will not suffice for the lower, and to obtain normal work a special water pipe must bring to the lower ones sufficient to make up any deficiency; so with the lamps. If the middle lead returns to the station it can either bring or convey away, if the two divisions are unequally burdened, sufficient electricity to supply the surplus lamps. In a large supply this difference will not exceed one-third, so that the extra lead only requires one-third the section of the others. Such a system is called a three-wire one. Now suppose the lamps fixed serially in four branches and we have the five-lead system, such as is about to be used in Königsberg, and which requires only about one-tenth the weight of copper as compared with the two-lead.

The Distribution of Energy by Means of Mordey Alternating Current Apparatus.

M. Leblanc describes in the London *Electrician* Mr. Mordey's interesting arrangement by means of which, any suitable continuous current machine may be employed, the field cores of which are laminated, as a motor on the alternating current circuit.

In the diagram it will be seen that in addition to the usual commutator C and collecting brushes B B', a second C' is provided, consisting of two segments, S S, which are connected directly with the brushes T T of the motor. The alternating current is led into the commutator by the brushes b b' from the terminals m m'. Between the segments S S are two smaller segments, s s, which are



Mordey Alternating Current Motor.

connected by a resistance R to avoid short-circuiting the mains at the moment of reversal.

It will now be seen that when the motor is running, until it has acquired its normal speed, the field magnets F receive an alternating current, but as the speed increases the commutator C' gradually transforms this in the motor circuit into a current uniform as regards direction. In practice C' would consist of more sections than two, thus not demanding so high a velocity.

In a motor so designed the value of the coefficient of self-induction appears to diminish as the speed increases, being a minimum when the alternating current is fully commutated, and from this point it again rises with the speed. The torque increases with the speed to the point of commutation, and then diminishes.

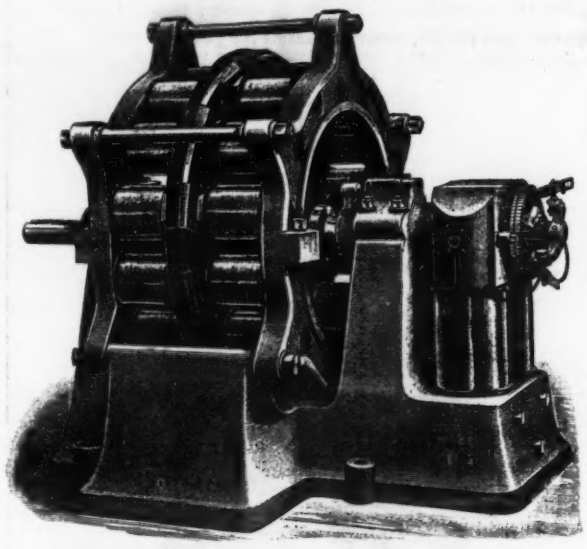
It is easy to see that this motor is self-starting, and there is no need to close the circuit on an intermediary resistance. The speed cannot exceed but very little the normal value at which commutation is perfect, for if it tends to do so, the self-induction increases, and the current and torque diminishes.

* Abstract of paper read before the New Polytechnic Society of Königsberg, June 19, 1889.

This machine would seem to furnish an excellent solution of the problem of the alternate current motor, but unhappily it presents all the disadvantages inseparable from the "redressed" current, employing what is actually an intermittent as well as a varying current in the motor circuit.

The Kapp Alternator.

Schio, a small town in Northern Italy, has now a central electric light station, which has been erected to the order of a local company by the Oerlikon Engineering Works. The generating and transforming plant is of the Kapp type, made by the Oerlikon firm, and we illustrate herewith, from *Industries*, one of the two alternators at this station. In this machine the armature has an iron core,



Kapp Alternating Current Dynamo.

composed of thin band iron coiled upon a cast-iron supporting ring, and provided with fibre driving horns, by which the armature coils are supported. The field magnet cores are cylindrical, and of wrought iron 4⅛ inches diameter, secured at their outer ends in cast-iron yoke rings, and provided at their inner ends with rectangular pole shoes, between which the armature revolves. On the armature there are 14 coils, each consisting of 80 turns of 120 mils. wire wound in two layers, and the armature resistance is 1.8 ohms. There are 28 magnets, each wound with 186 turns of wire, and the total field resistance with all the magnet coils in series is 1.76 ohms. The machine, when driven at 600 revolutions per minute, is intended for an output of 30 ampères at 2,000 volts terminal pressure; but, on trial, has been loaded up to 40 ampères. As will be seen from our illustration, an exciting dynamo is combined with the alternator, the magnets of the exciter being fitted into a prolongation of the main bed plate, while the armature is mounted on the spindle of the alternator. This dynamo is used not only for exciting the field of the alternator, but also for lighting the station. We are indebted to Mr. C. E. L. Brown, the engineer of the Oerlikon Works, for the following figures giving the result of a test of the machine. The speed was, during the test, kept constant at 600 revolutions per minute, and the terminal pressure was noted for different degrees of excitation, no current being allowed to flow through the armature of the alternator:

Exciting current. Ampères.	Exciting energy. Watts.	Terminal pressure. Volts.
9	142	1,000
14.5	368	1,700
17	510	2,000
18	573	2,100
21	775	2,400

When a current of 30 ampères was allowed to pass through the armature, the terminal pressure of 2,000 volts was obtained with an exciting current of 21 ampères. This requires an expenditure of energy for excitation of 775 watts, or about 1.3 per cent. of the total output; while the loss in the armature due to its resistance is 2.7 per cent.

Chicago Electricians and the World's Fair of 1892.

A meeting of the electrical industries represented in the West was held in the rooms of the Chicago Electric Club on Thursday afternoon, Aug. 20, to consider matters pertaining to the forthcoming World's Fair. The importance of the movement brought out a large attendance. Mr. B. E. Sunny explained the views of his committee, outlined the work to be done by the proposed sub-committees, called for suggestions and remarks, and concluded by naming the members of the different sub-committees. Mr. Alexander Kempt pertinently remarked that the members should allow nothing to stand in the way of securing the end desired.

The sub-committees appointed are as follows: *Electric wire manufacturers*, Fred Degenhardt, George Cutter, G. C. Bailey. *Incandescent apparatus manufacturers*, E. M. Izard, G. O. Fairbanks, C. C. Warren. *Miscellaneous electrical manufacturers*, M. A. Knapp, E. A. Sperry, Foree Bain. *Motor manufacturers*, C. M. Barclay, A. H. Lewis, T. P. Bailey. *Telephone companies*, T. G. Beach, Chicago; Henry B. Payne, Milwaukee; Flemon Drake, Omaha. *Arc apparatus manufacturers*, Alexander Kempt, F. W. Horne, Jno. L. Martin. *Central station lighting companies*, C. H. Wilmerding, F. S. Gorton, D. P. Perry, C. C. Haskins. *Electrical journals*, W. A. Kreidler, Fred De Land, C. C. Haskins. *Merchandizing companies*, F. S. Terry, W. H. McKinlock, C. D. Crandall. *Legal*, William Zimmerman, E. C. Ferguson, F. W. Parker.

Goldston's Automatic Short-Circuiting Device for Series Incandescent Lamps.

This new device, which we illustrate in Figs. 1, 2 and 3, has been especially designed by Mr. A. A. Goldston, of Middlesborough, England, and is employed in connection with lamps of the Bernstein type—though equally applicable to any other pattern—which are running in series with Brush arc lights, at the Birmingham Electrical Exhibition. By reference to Fig 2, it will be noticed that two strips of platinum T T are fastened to the leading-in wire W W, and fit loosely on to the china wedge V, which is suspended by the spring S. To the base of the wedge is fixed another strip of platinum P P, Fig. 3, the leading wires W W, running freely through large slots at the extremities of this strip. On the filament breaking, the two halves fly apart, and the separation of T T allows the springs to lift the wedge, bringing P P in contact with the two upper strips; the break is thus bridged, and the continuity of the lamp circuit is maintained.

Running A Dynamo as a Motor.

To the Editors of The Electrical World:

I have a small shunt wound dynamo (of my own make) of the Edison type, with drum armature, which runs nicely without sparking or heating. While running at 2,100 revolutions per minute it will supply ten 110-volt Edison lamps. With what results could I use it as a motor on the same kind of a circuit (Edison)? If it requires changing, what formula should I use to determine the armature and field. Armature.

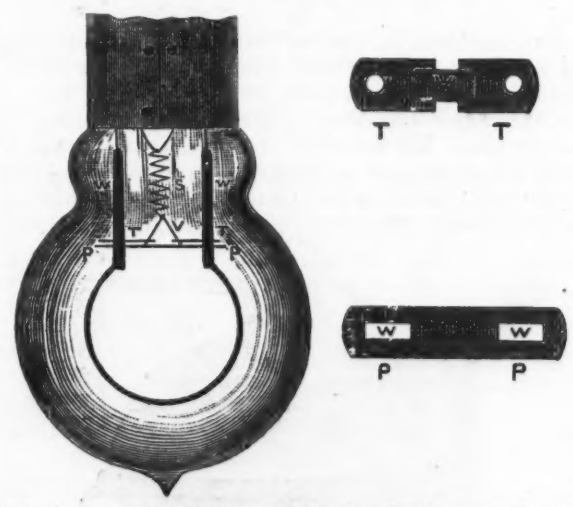
Dayton, O.

Answer.—The machine will run as a motor, care being taken in starting it not to connect the armature directly across the mains, as it would act as a short circuit when still. To start it, allow the current to pass through the shunt coil first, thus magnetizing the field; then throw the armature in parallel. Or, in lieu of this, use a little resistance in series with the armature, cutting the resistance out gradually as the motor attains speed. It is also necessary to give the brushes a slight backward lead to prevent sparking. If this machine is operated as a motor with 110 volts on its terminals, it will run at a speed a little less than 2,100 revolutions.—Eds. E. W.

Control of Leading Wood Patents on Arc Lighting Apparatus.

To the Editors of The Electrical World:

Inasmuch as the New American Electrical Arc Light Company, of 18 Cortlandt street, is manufacturing machines and lamps that are a direct infringement of my



Figs. 1, 2 and 3.—Goldston's Short Circuiting Device for Series Incandescents.

patents, and are apparently, by their advertisements, appealing to the customers of the old American Electric Manufacturing Company for support, I deem it proper that the public should be informed that this New American Electrical Arc Light Company does not own any of the patents that have been granted for my more recent and important inventions. These patents were my personal property, and the American Electrical Manufacturing Company, with which I was formerly connected, never acquired title to them.

The Fort Wayne Electric Light Company, for whom I am now designing and building arc light apparatus, controls all my patents that are of any importance, and my inventions covered by those patents will be embodied in the new arc-lighting apparatus soon to be placed on the market by the Fort Wayne Company.

I think the public should understand that the apparatus of the New American Electrical Arc Light Company is subject to my patents, and that the purchasers of such apparatus, as well as the New American Electrical Arc Light Company itself, are liable as infringers, and will be sued as such at the proper time. James J. Wood, Electrician.

Brooklyn, N. Y., Aug. 21, 1889.

Edison and His Inventions at the Paris Exposition.*

BY W. J. HAMMER.

(*Copyright*, 1889.)

About forty-one years ago, in Erie County, in the State of Ohio, was the enterprising and flourishing town of about 3,000 inhabitants, called Milan, beautifully situated at the head of the Huron River, and about ten miles from Lake Erie. Its thrifty inhabitants were given up principally to grain raising, cooperage and ship building. Upon the completion of the Lake Shore Railroad, the place rapidly declined, until it has almost ceased to exist. It will ever live in the memory of man, however, as the birthplace of the greatest inventor and discoverer of the age, Thomas Alva Edison, a man whose remarkable individuality, and whose herculean achievements in science and the arts have stamped an imprint deep into the civilization of our day.

It is to these achievements I desire particularly to call your attention; but first, I am sure you will be pleased to hear something of the man himself—of his early life and of his family.

His ancestors, on his paternal side, emigrated to America in 1730 from Holland, where they were extensive and prosperous millers. His great-grandfather was a prominent bank officer on Manhattan Island during the Revolutionary war, and his name appears on the Continental money. His race was remarkable for their longevity, he living to the age of 102, and his son, the grandfather of the subject of my lecture, lived to the ripe old age of 103. His grandson, Samuel P. Edison, is still living at the age of 85 years; he stands 6 feet 2 inches in height, and is hale and hearty. When 64 years of age he outjumped 260 men at Fort Gratiot, Mich., and not ten years ago challenged his son to a foot race in Menlo Park, and defeated him. He was born at Digby, Annapolis County, Nova Scotia, Aug. 16, 1804, and spent some of his early years in Newark, N. J., and at the age of seven removed to Bayham, Upper Canada. In 1837 he married Miss Nancy Elliott, of Vienna, Canada, and went West, locating at Detroit, Mich. A year later he removed to Milan, where he resided until 1854, when he removed to Michigan, learned the tailoring trade, and later went into extensive lumber business, and subsequently became a produce merchant.

His wife, Mrs. Nancy Elliott Edison, was of Scotch and English parentage. She was born in Chenango County, New York, January 10, 1810. She was for several years a teacher in the Canadian High School. She was very cultivated and fine looking. Her son received his early training at her hands, and she encouraged his reading, giving him a certain sum for each book he read. She died April 9, 1871, when he was but fifteen years of age. She left two other children besides Thomas A., a son, William P. Edison, now a prominent business man of sixty years of age, living in Port Huron, Mich., (where his father also resides), and a daughter, Mrs. Homer Page, who still resides at Milan, Ohio.

Mr. Edison has been twice married; his first wife was Miss Mary Stillwell, of Newark, N. J., whom he married in 1873. He had three children by this union, Miss Marion Estelle Edison, now a young lady at school, and two sons, Thomas Alva Edison, Jr., and William Leslie Edison. In their youth the first two were known as "Dot" and "Dash" synonymous with the Morse telegraph characters. Mr. Edison's wife died in 1884, and he was married again in February 24, 1886, to Miss Mina Miller, of Akron, Ohio, a daughter of Louis Miller, president of the Buckeye Reaper Company, and president of the Chautauqua Assembly. This union was blessed recently with a daughter, Madalaine by name, making in all four children in the Edison household.

The histroy of Edison's early life abounds in interesting reminiscences, and shows how true is the saying "the boy is father of the man" At twelve years of age, after trying his hand at shoemaking, which he disliked exceedingly, Edison began to earn his living as train boy on the section of the Grand Trunk Railroad traversing Central Michigan, where he peddled papers, magazines, nuts, fruits, etc.

In the intervals of thus annoying the passengers he dabdled in chemistry, the baggage car being his laboratory, until his experiments resulted in setting fire to the car with some phosphorus, when his apparatus was thrown from the train and he himself experimented upon with a shingle. He then secured the exclusive right to sell papers on the road, and employed four assistants.

Young Edison was very popular with the men about the *Free Press* office and was the only newsboy allowed in the composing room. During the late Civil War, it occurred to him to telegraph the war news ahead, and being allowed to copy the headlines in advance, he arranged with the operator to send them on condition that he was to furnish an evening paper every day and a *Harper's Weekly*. At the time of the battle of Shiloh, where 60,000 men were said to have been killed and wounded, Edison calculated that there would be a big demand for papers, and having a very small capital, he went to Wilbur F. Story, the proprietor of the *Detroit Free Press* and later of the *Chicago Times*, and told him he would like to be trusted for a thousand papers. Story opened his eyes with astonishment, for Edison was barely fifteen years old at the time, and very small for his age. He called up his manager and said: "Take that boy's order for a thousand papers." Edison rushed off and telegraphed the headlines which spread such terror and dismay thoughout the land; he hired a boy to assist him fold the papers on the train, and when he approached Utica, where he generally sold four copies, he saw what he supposed to be an excursion crowd at the station, but they were frantic people after papers, and he sold about forty. At Mt. Clements, where he usually sold twenty copies, the whole town and surrounding country had heard the news, and he and his assistant could not deliver them fast enough. "Only a few more left," shouted Edison; "price ten cents now," but the price seemed no object. At Port Huron station, his father's man met him with a wagon to take him to town, and on the way, seeing a great crowd rushing to meet him, Edison shouted: "Only a few papers, and the price is twenty-five cents." Every copy was gone before he reached town.

Over a year prior to this he had purchased three hundred pounds of old type from the *Detroit Free Press*, and he set up and printed on the train the *Weekly Herald;* the price was eight cents per month; its size was 11 × 8 inches at first, printed on one side and later on both sides. The circulation amounted to several hundreds. The celebrated engineer, George Stephenson, Jr., who was traveling in this country at the time, seeing Edison printing his paper in the baggage car, ordered a complete file of the paper to be sent to his address in England, and later extracts were published from it in the columns of the *London Times*, as being from the only paper ever printed on a train in full motion. The paper was devoted to market quotations, general railroad gossip, time tables, etc.

I take pleasure in exhibiting the only copy of the paper preserved in the country. It certainly is a remarkable piece of work for a boy of fourteen, when all the circumstances are considered. It bears the date Feb. 3, 1862. Edison, who was his own printer and publisher, set his type face upward in a frame with a track on each side; over this he rolled a heavy roller, pressing the paper down on the type. Subsequently he published another paper somewhat larger and handsomer, called *Paul Pry*.

While on the banks of the St. Clair River one morning he was seized by an irate subscriber who had taken offense at some article in the paper, which he considered reflected discreditably upon him, and he was thrown into the river and treated to a thorough soaking as well as a shrinkage in the list of his subscribers.

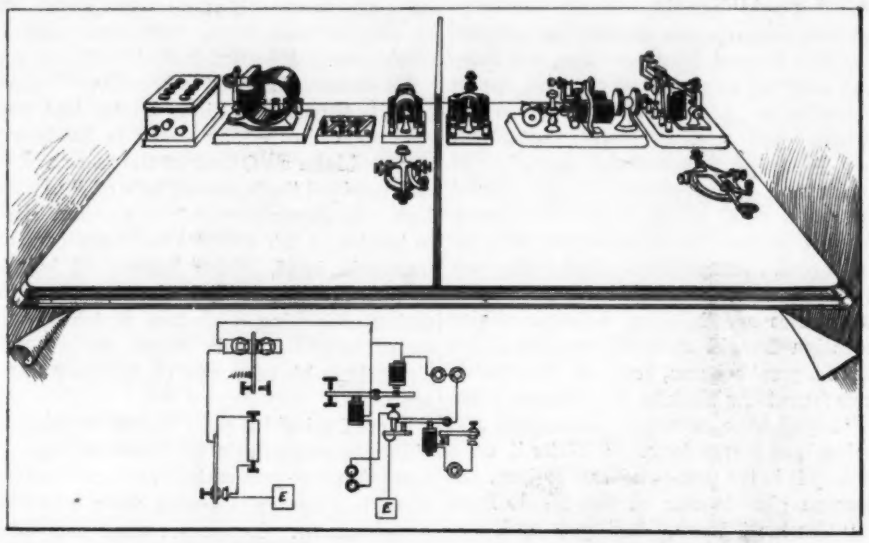


FIG. 1.—EDISON DUPLEX TELEGRAPH WITH DIAGRAM OF CIRCUITS.

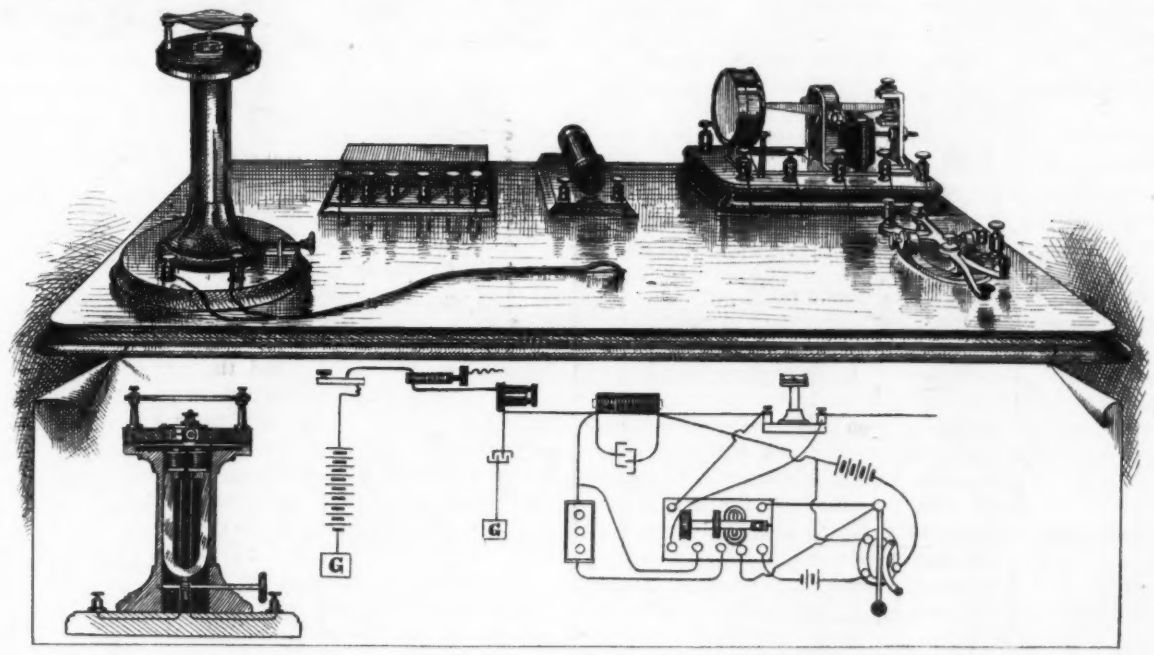


FIG. 3.—EDISON "PHONOPLEX," WITH SECTIONAL VIEW AND CIRCUITS.

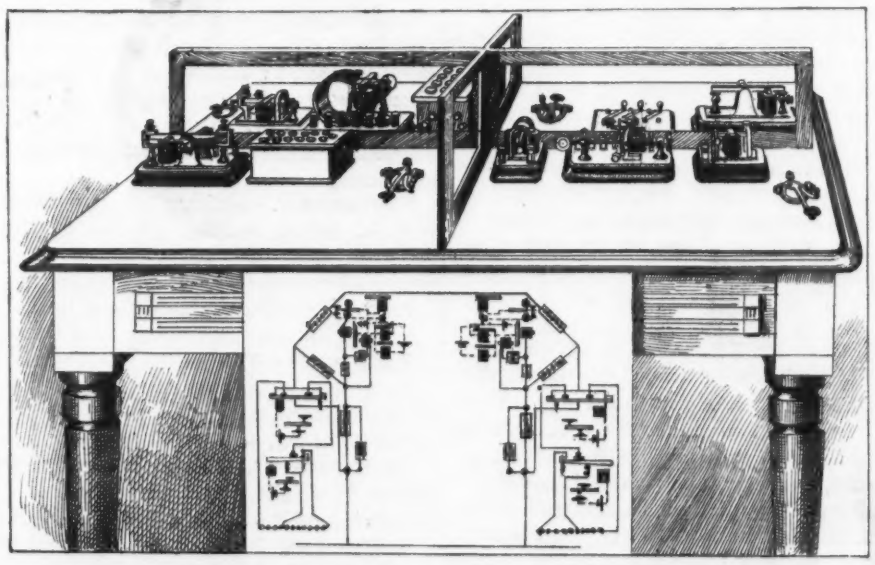


FIG. 2.—EDISON QUADRUPLEX, WITH DIAGRAM OF CIRCUITS.

* Based on lecture delivered before the Franklin Institute, Philadelphia, Pa., Feb. 4, 1889.

Edison had always stood in awe of the telegraph, and in common with many other children supposed the messages sent over the wire were in some way communicated by the paper being attached directly to the wire. After his experience in telegraphing the war head lines already spoken of, his admiration for the electric telegraph increased. About this time, at the risk of his life, he rescued from being run over by the cars the two-year-old son of J. A. Mackenzie, the station agent and operator at Mt. Clements station. As a slight reciprocation for this noble deed, Mackenzie offered to teach him how to telegraph, the very opportunity Edison desired, and each day he would leave his home at Port Huron, giving his order for papers to the baggage agent, who would secure them for him in Detroit, and then stopping off at Mt. Clements, he would put in five hours of solid work in the telegraph office, meeting the train upon its return with his stock of papers.

Inside of five months he was given employment as an operator, and on one occasion, in sending train dispatches, narrowly escaped causing a collision. Knowing that two trains were likely to meet on the same track, due to a mistake in his orders, he made haste to leave that section of the country. The accident, however, never occurred.

Edison soon became an expert telegraph operator, but was ill-adapted to be content with the routine work of a telegraph office. He was too prone to speculate on possible improvements in the art. This, with his fondness for reading, which was generally of a deep character for a boy of his age, caused him to neglect his routine work, and his changes of position were frequent. He was called a "tramp operator," although recognized as a most capable one. Boston, Indianapolis, Cincinnati, Louisville, Memphis, New Orleans, Stratford, Canada, New York, and other large cities where he was an operator at various times bear testimonp to his nomadic disposition at this age, and many interesting stories are told of his experiences and of his peculiar characteristics.

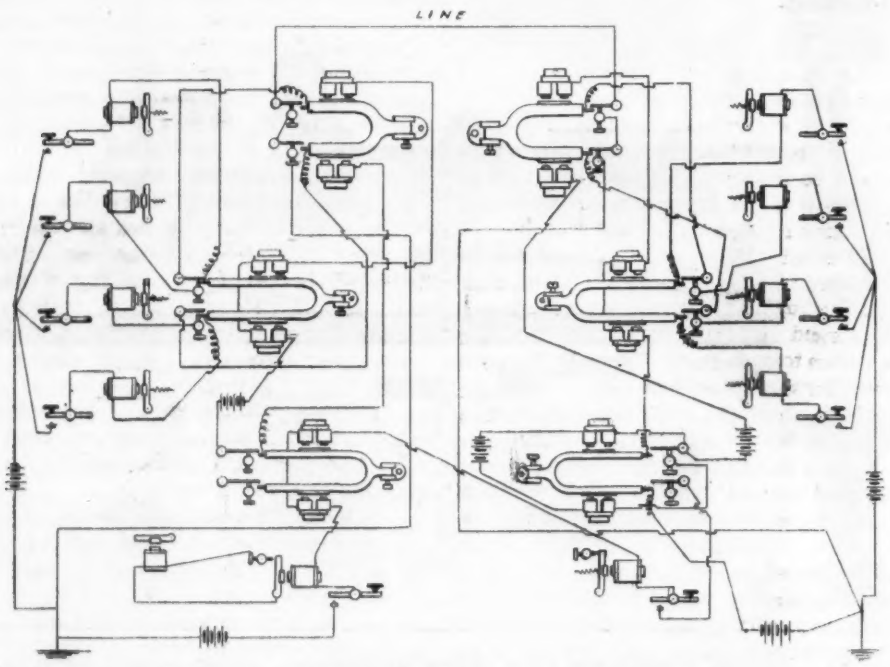


FIG. 4.—EDISON MULTIPLEX TELEGRAPH.

After making various experiments and inventions of minor importance, he set about developing a duplex system of telegraphy, trying his experiments between Rochester and Boston in 1870. They were for some reason a failure, and he shortly thereafter came to New York looking for a position. Without a cent in his pocket, he dropped in at the Gold and Stock Telegraph Office, and found things there in a great state of excitement, due to the failure of an important piece of apparatus, which the operator could not make work, thus causing serious inconvenience. Edison seeing that the officers of the company were in a great state of perplexity, suggested they allow him to try his hand at it, and upon their agreeing, he soon discovered the trouble and rectified it. He was about to rise, when they asked him to keep the seat permanently and offered him a good salary. He remained, at once began improving upon the instrument, and shortly brought out a superior one of his own, which, with other patents, was at once purchased by the company.

Edison says from this time forward he never had very much trouble to get on. The Western Union Telegraph Company, appreciating the remarkable fertility of his brain, effected an arrangement with him, by which, for a large sum of money per year, he was to give them the first bid upon any invention he might make in connection with the telegraph.

He removed to Ward street, Newark, N. J., where he had a large factory of several hundred hands manufacturing his various inventions connected with telegraphy, and in 1876 he removed to Menlo Park, N. J., a little hamlet of scarce a dozen houses, on the Pennsylvania Railroad, an hour's ride from New York. Here he erected a laboratory and workshop for purely scientific research and experiment, and from this humble place proceeded invention after invention, which astonished the world and caused Menlo Park to become the Mecca of a continuous stream of scientific men, reporters and curiosity-seekers.

The buildings were open to the inspection of all who cared to come, and in the early days of the invention of the Edison incandescent lamp, as many as five thousand people per day availed themselves of the privilege, special trains being run from various points. Here, surrounded with his staff of faithful workers of all nationalities, by his apparatus, machinery, books, chemicals and everything imaginable for experiment, the genial "Wizard of Menlo Park," as he was called, presided. Many people who have seen what he has accomplished imagine that he has a happy faculty of stumbling blindly over his discoveries, but those who have ever done any experimental work, will appreciate the fact that there is no "high road" to invention any more than to learning, and one successful experiment sometimes means a thousand unsuccessful ones, but of these we seldom hear. A commissioner of the United States Patent Office years ago called Edison "the young man who kept the path to the Patent Office hot with his footsteps." At the age of twenty-four he had forty-two separate inventions under way.

Many interesting stories are told of Edison's quaint humor. On one occasion he said excitedly to some of his friends: "Say, I have a great scheme, boys; do you know, I can send a message from New York to Washington without a wire." The "boys" were, of course, astonished and insisted upon knowing how it was done. "Write it on a piece of paper and drop it in the post-box," said Edison. On one occasion, a German glass-blower at the Menlo Park laboratory said: "Meester Edeson, don' you tink you could take dose lamps up in a balloon and fill dem mitt vacuum?" Edison replied: "That's a great scheme; we'll patent that." Some one remarked: "But how are you going to get oxygen up there to seal off the lamps with?" Edison turned about with pretended disgust and anger and said: "That's just the way; as soon as a man gets a grand, good idea some impracticable fellow comes along and tries to find some way to prevent its working." I remember on one occasion being very much impressed by hearing Mr. Edison say: "A man that can do something which no one else can do can get a lot for doing it." On another occasion I heard him tell some one to "go out and make a lot of enemies, as a man never amounted to anything until he had some"—meaning to imply, I presume, that a man to be progressive must be aggressive, and that an aggressive man is sure to produce some friction with those whom he runs up against.

I asked Mr. Edison recently how large a percentage of what is popularly termed "genius" was, in his estimation, inborn genius, and how much hard work and application, or "grit and gumption." He replied: "Well, about two per cent. is genius, and the rest is hard work." It may surprise people to learn that while Mr. Edison is but forty-one years of age, were his actual hours of labor considered, they would exceed those of most men of double his age. There have been times when for two weeks he never left the laboratory to go to his house, which was little more than a stone's throw distant, and one would think to see him at work, with his unkempt hair, his face, hands and clothes stained with chemicals, that he was utterly regardless of personal appearances, and to see him asleep, curled up on a table, his head on a book and his feet on some of the apparatus with which the table was bedecked, one would certainly say he was indifferent to personal comfort.

On one occasion, in Newark, N. J., when a certain printing telegraph machine had apparently failed, he locked himself up in the loft with five assistants, and declared he would not come down till he made it work, and work it did, although it took sixty hours' continuous labor. Notwithstanding his erratic habits of living, his health is uniformly good; his only ailment seems to be his faulty hearing, which was caused by his having been lifted into a freight car by the ears when a small boy, which injured both ear-drums. His deafness is a sore trial to him, and one he says he would give all his fame to obviate. It would be difficult to find a more unostentatious man than he; his tastes are very simple; he loves a good story, and can tell one in an inimitable manner, and those who have been associated with him can tell many a story of his mischievous pranks upon "the boys." He is always the first out with his hand, and will take as much pains explaining an invention to the humblest of his visitors, whom he sees really interested, as he would do to the distinguished personages who constantly come from home and foreign shores to see the man whose work has made him famous the world over.

He dislikes intensely to be called "Professor," a title frequently thrust upon him. He has had many honors showered upon him; among others, he has been made a Chevalier, and later an Officer of the Legion of Honor of France, and received the honorary title of Ph.D. from Union College. In appearance he is of medium size, 5 feet 10 inches in height, of fair complexion, and clean shaven, and his remarkable head, which takes a 7¼ hat to cover, is surmounted by a heavy growth of hair, now tinging with gray; and upon looking at his face, which is beaming with intellectuality and earnestness, one can see there (and most particularly in his keen, gray eyes), the stamp of a wonderful man.

Were I asked his chief characteristics, I should say, an ability to concentrate his attention upon one thing to the exclusion of everything else; an indomitable will and boundless energy, together with a wonderfully sanguine temperament. Sometimes when experiments have resulted in failure after failure, and after the patience and zeal of those about him were well nigh exhausted, he would cheerfully remark: "Well, boys, now we're down to hard pan, and now we'll go up." No better instance could be cited than the dynamo constructed which weighed over twenty tons, and which was sent to the Paris Electrical Exposition in 1881. Time after time, it was taken apart to get rid of trouble, or "bugs," as the electrical fraternity term them, and nights and days were consumed, during which Edison and his faithful assistants labored on, now and then snatching an hour or two of sleep by lying down in the testing room of the Goerck street machine shop, or stopping to eat a bit of the food sent in from a neighboring restaurant, but it was at last completed, and created a sensation at the Electrical Exposition, where no one believed Edison had built or could construct such a machine. There are many of them still in use to-day, although they have been superseded now by a much more advanced type of Edison dynamo.

Several years ago Mr. Edison removed from Menlo Park to New York, later to East Newark, N. J., and recently to his wonderful new laboratory at Llewellyn Park, N. J., where he has a collection of buildings constructed of brick and stone at enormous cost, and filled with the finest tools, apparatus and books the world could produce, and the whole given up solely to instrumental research, and constituting the most remarkable—in fact, the only—enterprise of its scope and character in the world. His various inventions, fostered by powerful corporations and bearing his name, give employment to thousands of men, thus realizing a high ambition of his youth. Of late, owing to the great rush of visitors to his new laboratory, which seriously interferes with the work, Mr. Edison has been forced to deny himself to all who call, save in exceptional cases.

A classification of his patents shows that his inventions cover a wide scope, though they are principally connected with the electrical field. They are as follows:

CLASSIFICATION OF PATENTS OF THOMAS A. EDISON.

TELEGRAPHY.—Printing and automatic, 52; chemical and perforating, 34; perforating machines, 6; chemical stock printer, 1; multiplex, 17; relays, 8; switches, 2; phonoplex, 3; induction relay Tel., 2; acoustic, 2; amr. & ind. signal app., 4.

ELECTRIC LIGHTS.—Incandescent lamps and manfr., 104; arc lamps, 4.

DISTRIBUTION.—Systems of regulation and indicating devices, meters, sockets, switches, 66.

GENERATION.—Dynamos, motors, 3: transmission of power, 54; regulation, 50.

RAILWAYS.—Electric motor and tracks, 8.

CONDUCTORS, UNDERGROUND AND OVERHEAD, 3.

TELEPHONES.—Transmitters and receivers, 32.

BATTERIES, GALVANIC AND SECONDARY, 3.

PHONOGRAPH, 21.

ORE MILLING, 4.

MISCELLANEOUS.—Electric pen and stencil app., 66; typewriter, 3; shafting, 1; malleabling iron; vocal engine, 1; preserving fruit, 1. Total, 493.

Besides these he has over 300 applications for patents pending on all subjects.

The various interests bearing his name, own many hundred other patents covering details and modifications of Mr. Edison's inventions.

I will now detail some of these inventions:

THE DUPLEX TELEGRAPH.

The duplex principle, which is due to Dr. Gintl, of Vienna, and owes its development more to Stearns, of this country, than to any one, bears the imprint of Edison's inventive genius as well; he having taken out no less than eleven patents upon duplex systems. These inventions, together with the general principles employed by others in the duplex, Fig. 1, he embodied with those of his sextuplex, and formed that magnificent invention of his, the quadru-

plex telegraph, which alone would have handed his name down to posterity as one of the greatest inventors that ever lived. This invention, President Orton, of the Western Union, stated, in his report in 1878, saved the company $500,000 annually in construction alone,

There are no less than 300 sets of quadruplex in use in this country alone, and were the same amount of business done to-day by the old methods, it would require no less than fourteen million dollars for extra wires, which, by the introduction of the quadruplex, become but "phantom wire," requiring no investment for construction or maintenance. The British government, which controls the telegraph in England, pays Mr. Edison a royalty upon the quadruplex, which is extensively used abroad.

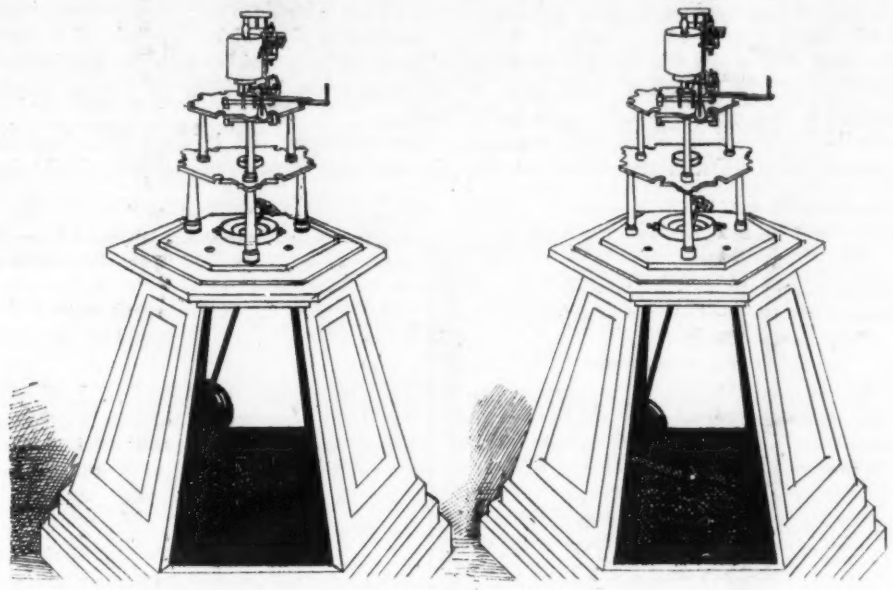


FIG. 5.—EDISON AUTOGRAPHIC TELEGRAPH.

The quadruplex is shown in Fig. 2, mounted on a table as operated, and also diagrammatically below, and the duplex is similarly shown in Fig. 1. It is needless here to enter into the details of these systems, which may be found in the various works on telegraphy, such as Prescott's book on the electric telegraph.

THE AUTOGRAPHIC TELEGRAPH.

This ingenious system, Fig. 5, is the joint invention of Edison & Kinney. Its province is to reproduce in one city the exact counterpart of a message written by the sender in a distant city, who writes his message with a stylus on a piece of bibulous paper, thus making a deep tracing of it thereon. The message is then placed upon a cylinder revolved by an electric motor, which is in synchronism with a similar motor and apparatus at the other end of the line, the cylinder upon this instrument, however, being of metal, covered with a sheet of chemically treated paper. A delicately adjusted spring is placed against the revolving drum at the sending end, and as the spring or wire passes over the paper and falls into the indentations produced by the message it closes the circuit at the distant end of the line, where an iron spring or wire decomposes the solution in the chemically treated paper on the revolving drum at the exact moment of making the circuit. As the pens at each end of the line are caused to move downward a trifle at each revolution of the drum, the entire message is accurately reproduced.

THE HARMONIC TELEGRAPH.

Edison, in common with many inventors, has spent much time in endeavoring to invent a satisfactory system of multiplex telegraphy by employing tuning forks actuated by electro-magnets. Edison has taken out a great many patents in connection with this field of work, and in Fig. 4 is shown his system of multiplex telegraphy, with which he has succeeded in sending as high as sixteen messages on a wire at the same time, eight in each direction.

THE AUTOMATIC TELEGRAPH.

Edison has devised a system of automatic telegraphy by which no less than 7,800 words have been transmitted between New York and Philadelphia in one minute without error. This he accomplished by perforating strips of paper with Morse characters. The perforated strips of ribbons are passed through the instrument as shown in Fig. 6 passing over a metal roller above which are fastened two springs with tiny rollers at the end, which bear firmly upon the paper and which make contact with the metal through the perforation of the strip. The regular Roman letter system employs a cable of five wires between the transmitting and receiving points. By this system a speed has been attained between New York and Philadelphia of 3,000 words. At the former they terminate in five roller springs as explained, and in the latter they terminate in five iron wires which bear lightly upon a strip of chemically treated paper passing over a metal roller. Each time a spring makes contact through a hole in the transmitting strip, a current passes over the line and decomposes the solution at the other end, producing a blue spot, this in the five-wire system forming letters, and in the two-wire system Morse characters. This system was operated for a number of years between New York and Philadelphia, and between New York and Washington, by the Automatic Telegraph Company and the Atlantic and Pacific Telegraph Company; and later, upon the absorption of these companies by the Western Union Telegraph Company, the Automatic became the property of that corporation.

THE "PHONOPLEX."

The Edison "phonoplex," as shown mounted upon a table in actual practice, as well as diagrammatically in Fig. 3, has been largely adopted in the United States.

This system is especially valuable for railway telegraphy, solving the problem of increasing the capacity of lines employed in way service, but it is equally well adapted for regular lines. Before referring to the apparatus, a few words upon the principle employed will be apropos.

It is well known that if the emission and extinction of the current in the "phone" be gradual, the diaphragm will be merely bent, and will turn to its original form without emitting a sound. But if the make and break in the current be rapid, the "phone" diaphragm will "snap," and so give forth audible sound. If, now, there are included in the same circuit a telegraph relay and a "phone," we may, by manipulating a key, operate the relay (and sounder) without producing a sound in the "phone," as the makes and breaks at the key are too gradual. But, if through the same circuit we send the rapid discharge current from the secondary of an induction coil, or the extra current from a primary, it will cause a loud click in the phone, but the current is too weak to affect the telegraph relay. Hence, by sending two kinds of current over the wire, we obtain two effects which can be readily utilized for the purpose above described.

The "phone," or receiving instrument itself, is a simple and ingenious apparatus, and is shown in section in Fig. 3. Resting upon a wooden base is a hollow column of brass, within which is placed a magnet with bobbins facing the diaphragm. At the lower end of the magnet there is a rack and pinion by which it can be adjusted with reference to the diaphragm. To the centre of the latter there is attached a screw-threaded pin, with the thumb-nut and binder at the top. Encircling the pin loosely is a split hardened steel ring which rests upon the diaphragm. When the latter is snapped by the attraction of the momentary current in the magnet, it throws the ring violently against the stop-nuts, and produces a sharp click, far louder than that from the ordinary sounder. The steel ring has a pin projecting from its side that passes between two prongs, which, while permitting free up and down motion, prevents the ring from turning and altering the sound. Over the top of the "phone" there is clamped a thin brass plate as a protection for the projecting screw.

The sending apparatus consists of a special form of circuit breaker worked by a Morse key and a coil of wire wound upon a wooden reel containing a soft iron core. This coil possesses considerable self-induction, the same being controlled within necessary limits by the shunting of an adjustable condenser. Naturally, breaking the circuit at the "Morse" keys would be fatal to the continuous working of the phonoplex apparatus; however, by shunting each key by a condenser, the continuity of the line for the "phone" transmission is maintained.

The phonoplex, which is the outcome of some of Mr. Edison's early duplex work, has been further developed into a triplex system equivalent to three independent circuits. The great advantages of the phonoplex, besides those referred to, are its simplicity, economy and perfect working in bad weather, when the Morse system is inoperative by heavy leakage.

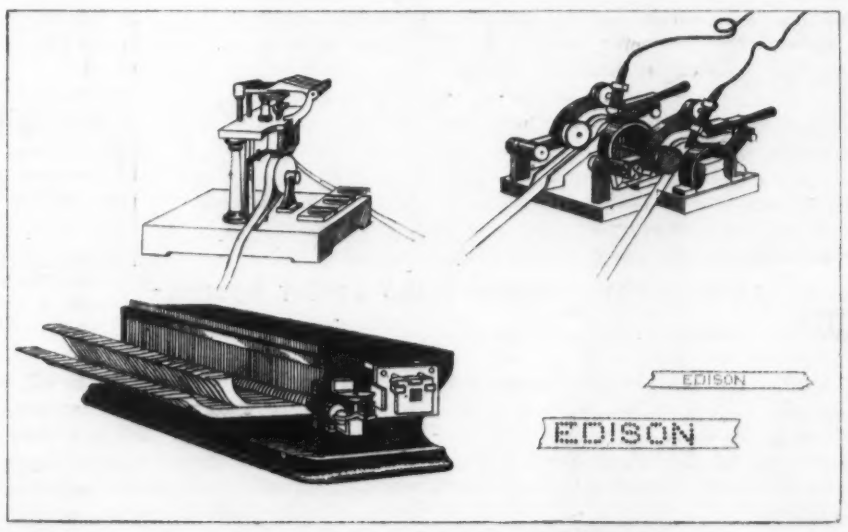


FIG. 6.—EDISON AUTOMATIC TELEGRAPH.

Mr. Harold P. Brown.

Electricians in search of interesting reading may be confidently referred to the New York *Sun* of August 25. A large portion of the Sunday edition of that paper was devoted to voluminous extracts from the correspondence held between Mr. Harold P. Brown, the "electrical engineer," and various individuals and companies in regard to apparatus to be used in this State for the purposes of electrical execution. It will be remembered that Mr. Brown has given out that his sole interest in furthering electrical executions has been that of any public-spirited and philanthropic man. At a very early stage of the proceedings, however, it became evident that his one aim was to employ Westinghouse alternating apparatus and, by its use as a death-dealer, to prevent its introduction for commercial purposes; and this feeling or suspicion did much to excite the growing aversion to the use of electricity at all as a means of capital punishment. This correspondence shows Mr. Brown in the attitude, not of a disinterested scientist, but of a man who, by playing off one company against another in various ways and by different subterfuges, has succeeded in making a neat little sum of money for himself.

With regard to the matter the *Sun* says: "Throughout the discussion over the proposed killing of murderers in this State by electricity, the name of the man who has figured most prominently in it is that of Harold P. Brown. It is Brown who has attended all the meetings of electrical and medico-legal societies and urged that criminals should be killed by the alternating current. It is Brown who has written about it in the magazines and reviews, commending death by the alternating electrical current as an extremely speedy one. It was Brown who conducted experiments upon animals, ostensibly at his own expense and out of the promptings of a benevolent heart, each of which resulted in proving (to Brown) that death by electricity, with the alternating current, was marvelously quick and painless.

"It is Brown's system of death by electricity that has finally been adopted by the State authorities having the matter in charge. Brown is the expert for the State in the trial, now pending, of the constitutionality of the electrical execution law, and the form of death by electricity as a punishment for murderers will probably go down to history stamped with Brown's name, as that of Dr. Guillotin is remembered in France.

"During all his talk and experiments Brown has pretended that he had no personal interest or connection with any electric lighting companies; that he was stirring in the matter simply as a scientific investigator, as a humane man seeking the quickest and most painless way of inflicting the death penalty upon criminals, as a kindly, public-spirited individual with a fondness for dabbling in electricity. Brown is known not to be a wealthy man, and that he could afford to devote all his time thus purely for the benefit of the human race at large with little thought of self has been a mystery to those acquainted with him.

"The *Sun* herewith prints copies of portions of Brown's correspondence with the officers of various electric lighting companies and other individuals, which bear strongly upon

the question of Brown's benevolence and public spirit, and go far toward solving the mystery referred to. The letters speak for themselves, but a brief synopsis of them may not be unnecessary. These letters show that while Brown was posing as a scientific investigator and public benefactor, the only controlling motive for his actions has been a desire to throw odium upon the alternating current system of electricity, and this, naturally, to the commercial injury of the companies using the alternating current, and to the commercial benefit of the companies not using it; that so far from being an "independent investigator," Brown has maintained the most intimate and peculiarly profitable relations with the electric lighting companies."

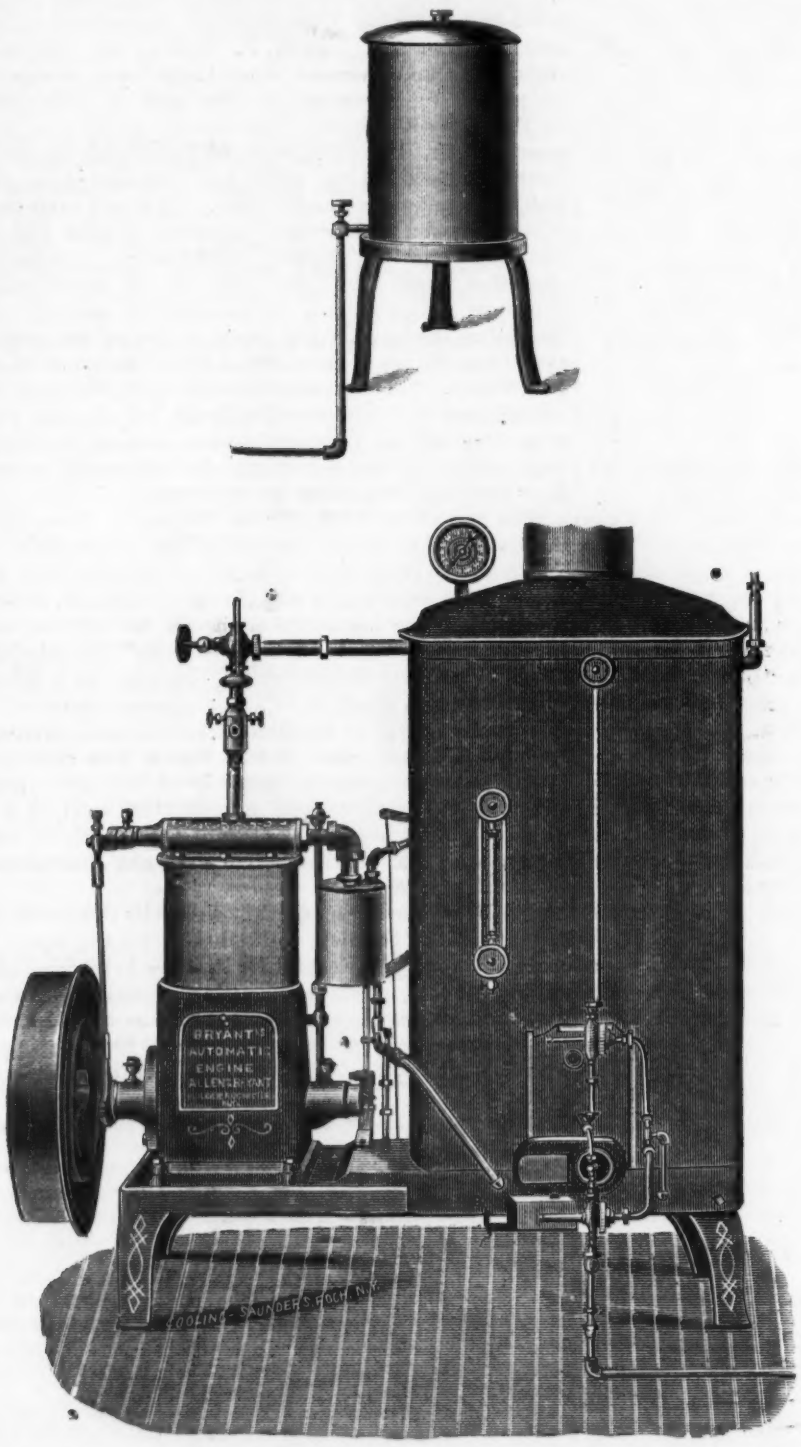
The letters printed are from Mr. H. P. Brown, Mr. T. A. Edison, and his laboratory electrician, Mr. A. E. Kennelly; Stern & Silverman, Edison agents, of Pittsburgh; Dr. Louis Duncan, of Johns Hopkins University, Baltimore; the Thomson-Houston Company; Frank Ridlon & Co.; the Edison Electric Light Company; A. H. Reece, Edison agent, St. Louis; M. D. Barr, the Edison agent in Montreal, and Dr. Carlos MacDonald, of the State Insane Asylum at Auburn, N. Y.; D. Nicholson, of the New York *Tribune*, Horace White of the *Evening Post*, and C. F. Dunston, Warden of Auburn Prison.

The *Sun* moreover in regard to a statement by Mr. Brown to the Thomson-Houston Company, that he had to pay the *Sun* in common with other papers for inserting his Westinghouse challenge without an "adv." at the bottom, says that it is "an absolute falsehood."

Bryant's Automatic High-Speed Safety Engine.

The question of using oil for fuel is one that is receiving no small amount of attention from the managers of large stations for electric light and power. It is also one of considerable interest to the owners and managers of small plants, and on this page we illustrate an engine and boiler outfit, to burn oil, that has been specially devised for such light work.

The engine illustrated in Figs. 1 and 2 is of the automatic high-speed type, employing kerosene oil as fuel. Fig. 1 shows the engine and boiler complete, and Fig. 2 represents the style of oil tank which is furnished with each engine and boiler. Among its advantages is the economy in the use of fuel, as the expense stops as soon as the work is done, and it consumes only an amount of fuel necessary for the power required, the quantity of steam being controlled by one of Allen's reliable fire regulators. The engine is an upright double cylinder, occupying, with the boiler, a floor space of 28 inches by 41 all over. There are no packed joints or stuffing-box, and it is well adapted for long night and day runs, there being no tendency to heating or pounding. The boiler is made in sections of an improved construction causing quick and free steaming. Each boiler is tested to a pressure of 600 pounds per square inch, cold water. It has a most rapid and natural circulation; all the sediment from hard or dirty water is deposited in the base, where it can be easily blown out while the boiler is hot or cold. The working portions run in bronze bearings, and the heavy driving parts are enclosed and revolve in oil, which keeps them free from dust, and makes the engine clean and prevents dripping of oil or water. All parts are made inter-changeable, reducing the cost of repairs in case of accident. This engine is especially adapted to be run by unskilled help, it being of such simple and strong construction, and needing no adjustment or packing of joints and rods. Every engine is thoroughly tested at its full power before leaving the works.



FIGS. 1 AND 2.—BRYANT'S AUTOMATIC HIGH-SPEED SAFETY ENGINE.

NEW BOOKS.

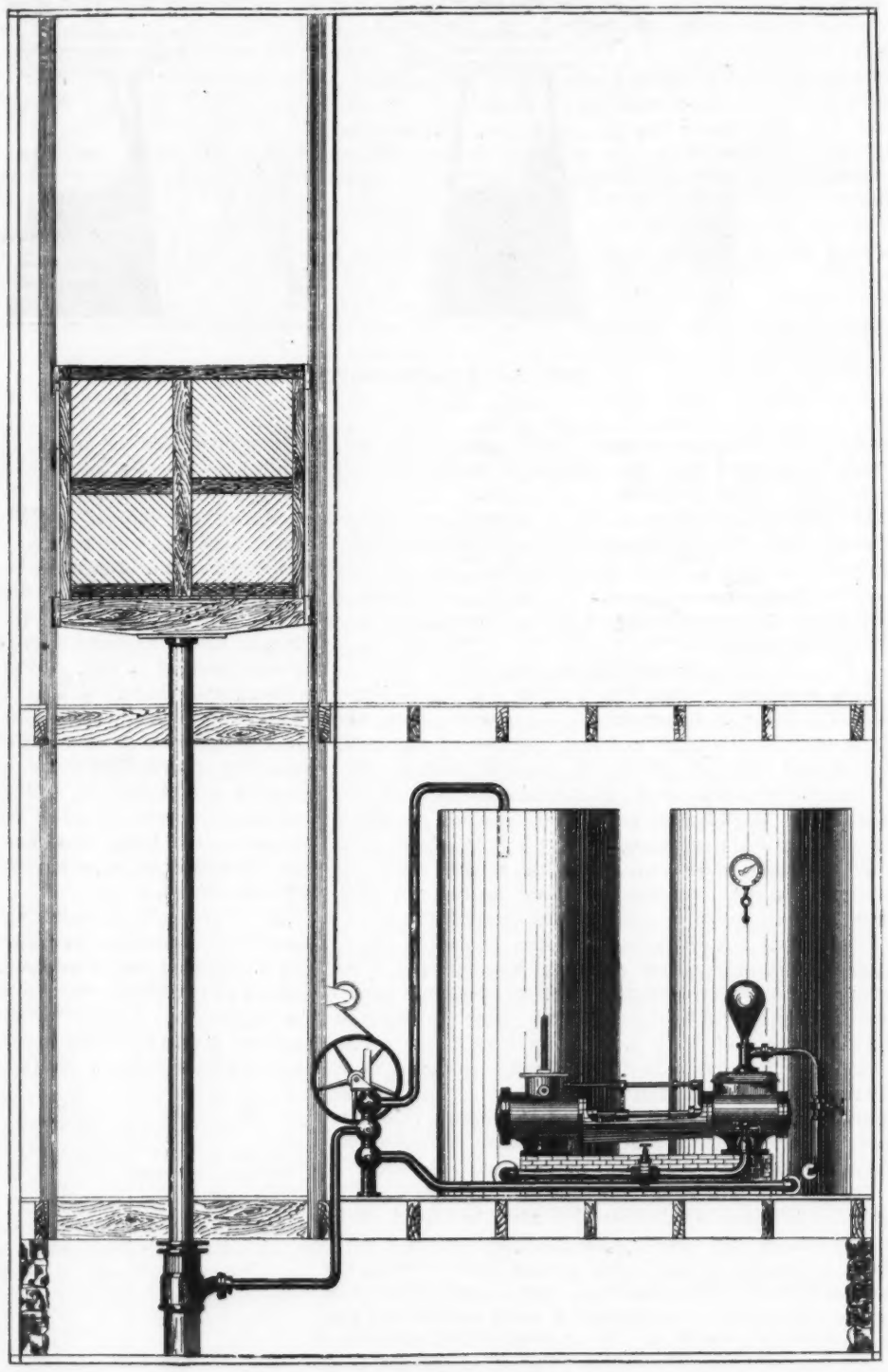
Economic Value of Electric Light and Power. (Second Edition.) By A. R. Foote. Cincinnati: Robert Clarke & Co. 1889. Pp. 189. Price $1.

The value and the popularity of this excellent work are shown in the rapid appearance of this second edition, and we seize the opportunity to commend the book to such of our readers as have not already studied its contents. There is hardly any subject of greater importance to-day than the disposal and enjoyment of municipal franchises, and Mr. Foote brings out very clearly the bearing that the question has upon the development of electric light and power.

The Eclipse Hydraulic Elevator at the Manhattan Electric Light Company's Station.

The Eclipse hydraulic elevator erected by the Tuerk Hydraulic Power Company, of No. 12 Cortlandt street, for the Manhattan Electric Light Company's station, at Avenue B. and Eightieth street, whose dynamo room was recently illustrated in our columns, possesses points of interest and merit that commend it to popular favor. The water pressure is obtained by the usual pressure-tank system, operated by a 6 × 4 × 6 Worthington pump, with a steam pressure of 60 to 90 pounds. The platform or car is lifted by a single tube of turned wrought iron, incased in a larger wrought-iron pipe, which is cemented in the solid rock to a distance of forty feet beneath the starting point of the car. The arrangement is shown in the accompanying engraving.

The maximum lift is 6,000 lbs. about 40 feet high; the elevator runs rapidly and smoothly, and takes up very little room, and as to its durability and safety, there can be no question. There are no ropes or cables to renew or break, and it cannot possibly fall, as the car is always supported by a column of iron. As the elevator is in almost constant use, the size of the pump would certainly indicate its economy The Tuerk Hydraulic Power Company are making a specialty of this style of elevator. Where hydrant water pressure is available the pump tanks are not required.



THE ECLIPSE HYDRAULIC ELEVATOR.

New York City.—An Edison plant is to be put in at an expense of $40,000, to light the Metropolitan Art Museum in Central Park.

Special Carriage Illumination.—Several wealthy Chicagoans are having their carriages wired for incandescent lighting, placing two or more small battery lamps in the interior and one on each side of the driver's seat, the necessary current being supplied from a set of storage cells placed beneath the carriage seats and recharged at one of the local lighting stations as often as required. The great convenience thus afforded has but to be once enjoyed to be thoroughly appreciated, as during long drives at night to country seats or suburban homes the tediousness of the journey may be dispelled or forgotten in the perusal of the late novel or the finishing of some fancy needle work by a member of the fair sex, all of which is easily accomplished under the perfect and steady light furnished.

Special Correspondence.

NEW YORK NOTES.

OFFICE OF THE ELECTRICAL WORLD,
167-177 TIMES BUILDING, NEW YORK, August 26, 1889.

The Telegraphers' Club of this city proposes to honor Mr. Edison with a dinner on his return from Europe.

Mr. Paul Hoenack, 191 and 193 Worth street, the maker of electrical instruments and light machinery, has made all the models for the Delany synchronous multiplex system of telegraphy, and has also built a variety of other important and well-known apparatus in various departments, including that for Mr. J. W. McDonough, of telephone fame

Hazazer & Stanley, 34 Frankfort street, owing to the demand experienced from their customers, have found it necessary to make some special skeleton and wood box bells. These are made on new and advanced principles of construction, and of the best materials, and can stand long service, being constructed not simply for cheapness, but for endurance and to give satisfaction.

John A. Roebling's Sons Co., of 117 and 119 Liberty street, have just issued a very neat and tasteful little pamphlet in regard to their wires and cables of various materials and sizes. The lists given include underwriters' wire, bare copper wire, galvanized iron telegraph wire, German silver resistance wire, lead encased wires and cables, incandescent lamp cord, annunciator and office wires, annunciator cables, etc. Prices are also furnished, with a code for ordering. There are also useful tables of information.

The Palermo Mica Company, 27 Peck Slip, are said to own and operate the largest and most productive mica mines in the world, the quality produced being of the finest in the market. They make a specialty of the mica business, and are in a position to fill orders promptly for any size, shape and quantity on the most favorable terms. They have every facility to furnish mica cut in any shape desired to specifications, and request an opportunity to bid upon large orders of mica to be furnished at short notice and good terms for all electrical purposes.

The Clark Electric Company, Corbin Building, are out with a remarkably tasteful catalogue or pamphlet relative to their system of electric lighting, as recently described and illustrated in your columns. Each of the details of this ingenious system is illustrated, and the accompanying text enters into a careful explanation of its advantages. The elegant pamphlet is fitly prefaced by a page showing the medal of superiority awarded by the American Institute in 1888, and the whole is enclosed in a stiff cream-colored cover, lettered in brown ink.

The Electric Construction and Supply Company, 18 Cortlandt street, have been reorganizing, and new life has been infused in the person of Mr. R. B. Corey, who has taken the helm of the company. They are now pushing the interests of their new Kinsman arc lamps for multiple work on incandescent lighting and power circuits. These lamps are called the Kinsman single lamp, Kinsman multiple series lamp, Kinsman double lamp, and Kinsman search lamp—all for low tension currents. They have many recommendations, and are badly needed for such circuits, as the recent Edison convention showed. The company are also pushing work in their construction department, and have some of the largest new buildings on their list, such as the Corbin, Mutual Life, Stewart and others, not forgetting the Brush Grand Opera House, of Detroit. The officers of the company are: F. E. Kinsman, president; H. Torrey, of Boston, vice-president; S. T. Hillman, secretary and treasurer, and R. B. Corey, general manager.

Arc Lamps on Edison Circuits.—In the discussion which took place at the recent convention of the Edison Illuminating Companies at Niagara, considerable interest was manifested in the question of arc lamps on Edison circuits, and the matter under clause 7 of resolution offered by Mr. Gilbert, of Detroit, fails, it is said, to give the correct impression regarding the present state of the art. In this particular he refers to the Simplex lamp, as used in Harrisburg and other places, and seems to class all lamps of this character in the same category. The fact is, however, that the Electric Construction and Supply Company, of 18 Cortlandt street, New York, who were the pioneers in placing the Simplex arc lamp upon constant potential circuits successfully, and who sold the above mentioned lamps to the Harrisburg Company, have, within the past six months, placed upon the market a lamp known as the Kinsman arc lamp, and are now offering them in place of the Simplex arc lamp, of which they have become the sole owners in the United States. It burns steadily in *multiple series* on from 100 to 500 volt circuits, either incandescent or power. They claim for this lamp upon incandescent circuits, of say from 110 to 220 volts, greater economy per lamp upon the incandescent circuit than can be obtained through the use of an ordinary series circuit arc lamp; as by the use of the improved lamp the current formerly wasted in the Simplex lamp and the resistance are reduced to a minimum, while it possesses remarkable attenic qualities not met with in any other arc lamp of any system known to the writer, and it is confidently asserted by the company that the capacity of an incandescent electric plant is greatly increased, and the long felt want of a simple and effectual means of providing either temporarily or permanently a few arc lights is fully met by its use, and provides the means of preventing the introduction of a separate system for meeting the requirements of those who desire an amount of illumination in large spaces unattainable by the reasonable and economical use of incandescent lamps. Also that the output of incandescent dynamos and fittings will be greatly increased on account of this addition to electric light apparatus. The great trouble experienced with the Simplex lamp was its inadaptability to circuits of more than 60 volts pressure, it being impossible to use it across the outside conductors of the three-wire system without, as stated in Mr. Gilbert's resolution, the use of expensive and wasteful resistance. The use of the Kinsman lamp also does away with the public cry of danger where arc lights are used for street or other lighting, a matter of no small importance in city lighting.

An Improvement in Incandescent Reflectors has been recently patented by A. A. McCreary, of 18 and 20 Cortlandt street, New York, and he is now prepared to put it upon the market. It is highly commended by all who have seen it, and it will rapidly grow in favor, as its usefulness and beauty is unquestioned. The orders already almost outrun the supply. It certainly possesses many advantages over any shade that has yet been made for chandeliers over billiard tables, and for any incandescent lamp that is not placed in a perpendicular position. It conforms to the shape of the incandescent bulb, covering one-half of it, and is movable around the same so as to direct and concentrate the rays of light in any direction at will. It has a brass base that is connected to any ordinary two-and-a-quarter inch holder, and revolves in the same. They are made of metal or glass. The latter are opal, silvered, and in all colors for fancy lighting. They can be fitted to any of the ordinary forms of incandescent lamps without any further expense than the cost of the shade, and by having a selection of shades of different colors a variety of strikingly beautiful effects may be produced with an ordinary electric lamp, making them especially advantageous for stage lighting. The opal shades are best adapted for libraries or reading-rooms. By means of this revolvable and adjustable shade or screen any desired effect may be produced, such as any color, a given direction, an increased illuminating power, according to the peculiar purpose for which the lamp is employed. It entirely does away with the colored bulbs, which are very expensive and of short life. This half shade is also intended for arc light globes, directing all the light where needed. At present Mr. McCreary has only made this new shade of glass, and for 16 c. p. incandescent lamps, but will soon have them for any candle-power incandescent and for arc lights, in either metal or glass. This half shade does not in any way interfere with Mr. McCreary's silvered reflector, which has now become the standard for all kinds of desk work. He informs me that, although he has twice increased his facilities for making the silvered reflector during the past year, the demand is now nearly equal to the supply and increasing daily. Mr. McCreary has a large number of testimonials from leading business houses in this country commending his reflectors in the highest terms. He has just added to the silvered reflectors what he calls the "Mogul," being a special size for 100 to 250 c. p. lamps; and although he has been making this mammoth reflector only ten weeks he has had six orders for them from a single Western firm. Mr. McCreary has just secured the exclusive rights of the United States to manufacture and sell a reflector and guard for incandescent lamps for street lights, also for factories and mills. He is now preparing to issue a handsome catalogue of the various articles that he has exclusive control of. W. T. H.

PATERSON, N. J., Aug. 26, 1889.

The Globe Fan Company, Paterson, N. J., have lately brought out a new and improved fan for ventilation and air circulation purposes. It is well designed, keeps the air in rapid movement, whether in the room or large factory, and should be largely used in connection with electric motor fan outfits.

The Riverside Plastic Company, of Paterson, N. J., are making a new insulating compound, which is said to be equal to hard rubber, in imitation of which it can also be molded into any required pattern or design. It is now in use by large manufacturers of batteries for covers, etc., and is being well spoken of.

Mr. M. M. Fleron, 225 Market street, Paterson, N. J., is the leading electrical furnishing and household engineer in this part of Jersey, and carries a full line of bells, burglar alarms, annunciators, door openers, etc. He has facilities also for repair work, and is always ready to seize new opportunities for the introduction of specialties.

C. McIntire & Co., 36 Crawford street, Newark, N. J., are constantly adding new specialties to their already long list of electric wire connectors, terminals, etc. They are now preparing a big order of 9,000 loops for electric railway work; also 25,000 No. 12 B. G. connectors for hard drawn copper wire, and a large order for lightning arresters.

Mr. E. Francisco, Little Falls, Passaic County, N. J., is well known as a constructor of telegraph, telephone and electric light lines, and has to his credit, I believe, the building of all the principal lines of the New York & New Jersey Telephone Company, as well as the long distance telephone lines and poles west of the North River. He has lately put up the pole line for the Dobbs Ferry Electric Light Company. He is equipped for prompt work, and carries a full line of chestnut, cedar, Norway pine and other poles for all classes of work. He also contracts for the repair and maintenance of lines.

The Edison Electric Illuminating Company, of Paterson, N. J., Wm. M. Brock, general manager, are now furnishing 4,000 Edison lamps and 60 American arcs for general purposes, and have in service six No. 20 Edison machines and four American machines. They have one New York Safety automatic engine of 175 h. p.; two Ball engines, and two Halsey engines, made by the Cook Locomotive Works, of Paterson. They are now installing another Ball engine of 200 h. p., and two more Edison dynamos, in ordered to meet the demand on them for current and lights. They run all their wires underground in the main streets, the Edison tube system being employed. Heavy okonite insulation is used for the bus wires to the feeders. The arc wires are also run underground in wood conduits, and with okonite heavy insulation, and Mr. Brock says they have met with perfect success. The company are supplying about 100 h. p. of current for Sprague motor work, and have recently supplied the Cook Works with a 15 h. p., and a 10 h. p., 1½ miles from the station, is running a silk mill, and the two leading daily papers are also run by motors in preference to steam engine. Two churches are using motors for organ blowing, and the motor generally is very popular. The light is in widespread use, and is to be found in churches, stores, offices and residences. The station itself is handsomely arranged, with a raised platform overlooking the dynamo and engine room and containing all the various Edison instruments handsomely fitted up in oak. Mr. Brock, who is in charge, introduced the telephone system and the Edison system at Shamokin, and four years ago he went to Lawrence to manage the Edison station there. On April 1 he took charge of the Paterson station now running so successfully. He has recently sold a plant of 500 Edison lights to Jacob Walders and 100 lights to Jacob Frisch, which he will install immediately. W. T. H.

NEW ENGLAND NOTES.

BRANCH OFFICE OF THE ELECTRICAL WORLD,
Room 8, Cook Building, cor. Franklin and Congress Sts.
BOSTON, Aug. 24, 1889.

Gardner, Mass.—The Gardner Electric Light Company have just installed in their plant two heaters manufactured by the Wainwright Manufacturing Company of Massachusetts, of Boston.

Salem, Mass.—The electric light company, which is now working from its new station on Peabody street, has placed the contracts for the inside wiring in the hands of the Wright Electrical Engineering Company, of Boston.

Medford, Mass.—The Wainwright Manufacturing Company of Massachusetts, of Boston, whose factory is in this city, have placed an order with the Thomson-Houston Electric Company for a 200-light incandescent dynamo for lighting their extensive shops.

Holbrook, Mass.—A franchise has been granted by the Board of Selectmen to the Randolph & Holbrook Electric Light, Power and Gas Company, with the right to establish a plant, erect poles and string wires within the limits of the town. The plant must be built within six months.

Brunswick, Me.—At a meeting of the Brunswick Electric Street Railroad Company Mr. Weston Thompson was chosen as President, and Mr. F. H. Wilson as secretary and treasurer. The capital stock is $25,000. The storage battery system will be used, and it is expected that the road will be in operation by the middle of October.

West End Street Railroad Company. The Massachusetts Railroad Commissioners have granted the West End Street Railroad Company permission to issue $4,000,000 of the proposed $4,500,000 common stock. Meantime the work of overhead construction is being pushed vigorously along, and the work of rebuilding the car tracks will be begun immediately.

Mr. T. McCoubray, who has been so long well known in connection with the Baxter Motor Company, and also as secretary, in past years, of the National Electric Light Association, has now come to Boston to live, and will make his headquarters at 620 Atlantic avenue. Mr. McCoubray has many friends in the East, and will doubtless be received with all honors among the electrical fraternity of the Hub.

Newton, Mass.—At a meeting of the stockholders of the Electric Street Railroad Company Mr. George W. Morse was elected president, and Mr. F. G. L. Henderson superintendent of the road. The road will run through Newton, Waltham and Watertown, and work will be commenced at once. The money has been paid in on the stock, and everything will be done to render the equipment and service first class in every particular.

Weymouth, Mass.—The Wright Electrical Engineering Company have completed the outside construction of the arc lines for the Weymouth Electric Light and Power Company, and have now secured the contract to do all the inside wiring for incandescents. About 1,000 lights will be put in at present, and current is expected to be turned on some time in September. The electric light company have just made contract with the Wright Electrical Company to commence work on the outside construction for incandescent purposes.

Providence Construction Company, Providence, R. I.—This company has been organized, with Mr. E. W. Fyler as manager, for the purpose of doing a general construction business for all classes of electrical work. Mr. Fyler has been for years connected with George H. Thurston & Co., of Providence, and in his new sphere is meeting with marked success. Mr. Fyler has been remarkably successful in past years as a designer of special electric appliances, as his record in Providence will amply show, and deserves the most hearty support of his friends.

Frank Ridlon & Co.—Success shines upon this enterprising firm of dealers in second-hand electrical goods. Mr. Ridlon has recently sold three 6 h. p. Baxter motors of constant current type. Of these one is for the Johnston Hotel, Shawmut avenue, Boston, for elevator purposes, one for the New Bedford Gas Company, and the other has been sold to the Attleboro Electric Light Company, and is also to be used for running an elevator. Within the past two weeks Mr. Ridlon has sold over twenty-five horse-power in motors and ten multipolar dynamos.

Thomson-Houston Motor Company.—This company, originally a department of the Thomson-Houston Electric Company, have now got fairly to work in their new capacity as a separate company. Under the able guidance of Mr. H. C. Spaulding, they will continue to push specially for mining and mill work, and look for a very large business in this field. Transmission of water power electrically opens another very large field, and there is practically no limit to the business which can be gathered in in this line by a company with such an energetic manager as Mr. Spaulding.

Bernstein Electric Company.—The series incandescent lamps placed in the International Hotel, Niagara Falls, which were exhibited in operation by the Bernstein Electric Company during the Electric Light convention, proved so satisfactory to the hotel proprietor and his patrons that the entire outfit was purchased by the hotel, and arrangements made with the local Brush Company to supply the current. The Bernstein Company appears to have just what the local arc companies require, a good, reliable lamp for burning in arc light circuits, and they report a rapidly increasing demand for their goods.

The Wheeler Reflector Company have just issued a very handsome and complete catalogue of their various styles of reflectors. The illustrations show reflectors of all shapes and sizes, from the simplest kind of metal reflector for cheap but substantial work in factories to the most elaborate mirror reflectors for use as chandeliers in churches, halls or other public places. There is no kind of reflector, of whatever shape or size, for arc or incandescent light, that the Wheeler Reflector Company cannot supply, and all contractors for electric light would do well to procure for themselves a copy of this tastefully-designed pamphlet.

Thomson-Houston Electric Company.—It is reported that the Electric Car Company of America, composed largely of Philadelphia capitalists associated with street railway enterprises, has transferred to the Thomson-Houston company all its rights, title and interest to electric car propulsion, by either overhead or underground wires, and will hereafter work in harmony with the Thomson-Houston Company. This contract carries with it the assignment to the Thomson-Houston company of the patents and inventions of Rudolph M. Hunter, Condict and others, controlled by the Electric Car Company, and also an exclusive license under the celebrated Reckenzaun motor patents.

Simplex Electrical Company.—Dr. Mason, who has so well and ably guided this company to the high position which it occupies, showed me to-day some specimens of his new waterproof insulated wire, which he is making in all sizes from No. 20 B-S gauge to 0000 B-S gauge, solid and stranded. By his plan he puts on over tinned copper a first quality rubber insulation *without any seam.* Outside of this a braid or braids are used, saturated with a compound which is unaffected by illuminating, sewer or other gases, or by the action of the atmosphere. Already Dr. Mason has received considerable orders, and anticipates this fall a large business in this specialty. To all familiar with wire the quality of Simplex is well known, and with the addition of the rubber covering next the wire it is safe to expect that the new wire will be as near perfection as it is possible to be.

The "Kodak Party."—This name was given to a party of ladies and gentlemen, who were led by the "Kodak fiend," Mr. Alex. P. Wright, during a delightful trip from the scene of the Electric Light convention at Niagara Falls, by a circuitous route back to Boston. The party consisted of Mr. Wright, Mr. Fred. Pettingell and wife, Master Roger Pettingell, Mrs. Lowe, Miss Ridlon, Mr. P. H. Alexander and son, and Mr. Fred. Whipple and wife. Leaving Niagara Falls on Thursday, the return trip was made by way of Toronto, the Thousand Isles and Montreal As this country is all familiar to Mr. Wright, he acted as guide to the party, and so well did he succeed in his part of cicerone, that the other members presented him with a small token of their thanks, and as a souvenir of a thoroughly good time, in the shape of a very handsome briarwood pipe. The gentlemen of the party showed their appreciation of the presence of Miss Ridlon, by presenting her in Montreal with a very handsome basket, containing sufficient candy to satisfy her appetite in this line for the remainder of her natural life.

Pettingell, Andrews & Co.—I had occasion to go in to see Mr. Pettingell the other day, but was rather astonished, on enter-

idg, that my line of vision was entirely intercepted by two huge "K. W." cut-outs standing in front of me, which made me imagine for a moment that my eyeglasses had suddenly developed from their normal state of concavity into the strongest kind of convex lenses. After recovering my breath and realizing that I was not the subject of a hallucination, I examined, with pleasure, the two exaggerated models of this most useful and popular article. One is in walnut and the other in mahogany, and they are about fifty times as large as the ordinary cut-out. They are fitted complete with polished brass binding screws of herculean build, and altogether present a most attractive and unique appearance. To say that these cut-outs are selling like hot cakes, would be to inadequately express the truth, as later on, when I called again, I found all hands, from the esteemed head of the house down to the office cat, busy packing the little boxes to fill the large orders which are daily coming in from all parts of the country. So rapidly has the business of Pettingell, Andrews & Co. grown, that it has been found necessary to secure more commodious quarters, and they have leased the ground floor of the Estes Press building (immediately behind the offices of the Thomson-Houston Electric Company) for that purpose, and intend moving there probably some time in October of this year.

The Portelectric Company.—This company, whose working model in the old South Church, Boston, has been creating such a deep interest, has now completed arrangements by which they have secured for one year or more a piece of land on the New York & New England Railroad at Dorchester, between Howard street station and Mount Bowdoin station. The structure will be about a mile long, and will be oval or rather pear-shaped. The superstructure, being a temporary one, will be of wood, and will probably stand about six feet high, and will be fitted thoroughly and completely with the helices and complete apparatus required for the working of the plant. The contract for the super-structure has been let, and a survey made, and work will be commenced very soon. The structure when finished will show straight sections, curves, grades, curved grades and switches, and everything will be made as thorough and as varied as possible, so that complete data may be secured on which to base the calculations for a long line. The helices will be about six feet apart, and the carriage will be twelve feet long, with a circular section of about ten inches. Much interest is being felt in this big experiment, and it is safe to say the eyes of the whole electrical world will watch with intense interest the success of these trials. Mr. Williams is to be congratulated upon carrying his invention thus far, and it is to be hoped that brilliant success will attend his future efforts. A. C. S.

PHILADELPHIA NOTES.

Branch Office of The Electrical World,
31 City Trust Building, Philadelphia, Pa., Aug. 5, 1889.

The National Electric Light and Power Company.—Some of the most recent plants installed by the above company are the following: Twenty-five lights for Dr. Schoms, at Ashland, Pa.; Alfred Box & Co., 50 lights, Pedrick & Ayres, machinists, 100 lights.

Messrs. Armstrong & Conner, who make a specialty of incandescent wiring, have obtained the following contracts: Mr. John R. Bennet's residence at Danville, 300 lights; Arnholt & Schafer's Brewery, 250 lights; in Media, Pa., 1,000 lights; Mr. Kennedy's residence, Bradford Hill, 150 lights; Mr. Schur's residence, Scranton, 200 lights.

Alfred F. Moore is very busy filling orders in large and small sizes of his well known wire, and he reports the demand especially brisk in white core rubber-covered wire. I had the pleasure of visiting Mr. Moore's new and handsome engine room a few days ago. The 80 h. p. Corliss engine runs two dynamos, one of 100-light capacity and the other of 30 lights, for illuminating the building.

Churchman & Co. have received large consignments of their famous chromic acid, and are now stocked up to meet the largest demands, although filling big orders right along. The demand for this specialty for battery work has been very great, it having many points of advantage and superiority over the old method of employing bichromate of potash. Their product has been extensively used by Mr. Edison for his phonograph batteries.

The Kensington Engine Works report the following shipments: Four 20 × 40 300-h. p. engines to the Brush Electric Light Company, of Baltimore, making 10 engines in that station, which is arranged for an increase of six more, making a total capacity of some 4,000 h. p. in all. Four engines, each of 100 h. p., to Annapolis; one 20 × 40 to the Camden Electric Light Company; one 120 h. p. to the Edgemoor Bridge Works for an isolated plant.

Tatham Bros., who make a specialty of underground and submarine lead-covered insulated cables, report that their 64-wire, lead-covered, armored telephone cable, which runs across the Delaware River, connecting this city and Camden, is giving perfect satisfaction, having been down now nearly four years. They also have an underground cable, supplied to the city on North Broad street, laid three years ago, and one mile on Front street, two years down, both of which are in excellent shape. They employ a special process for putting on their lead, which absolutely prevents any holes, even the size of a pin head, appearing in the covering, and to this fact they attribute their continued success with lead-covered cable.

Messrs. Schleicher, Schumm & Co. report having just sold quite a number of 50 h. p. Otto gas engines for electric light work. They have also very lately shipped a 100 h. p. to Raleigh, N. C. Some of their claims of the advantages gained by gas companies operating electric light plants, employing gas engines for this purpose in place of steam, are as follows: When steam power is used in electric stations there is considerable waste of fuel due to the necessity of keeping fires banked. With gas power the cost is strictly limited to the time used. This is especially advantageous when the service is of a spasmodic nature; there is also the revenue derived from the sale of the by-products from each ton of coal carbonized.

Messrs. H. M. Sciple & Company report the following sales of engines and boilers during last week: To the Edison Illuminating Company, of Pottsville, Pa., two 16 in. × 16 in. 150 h. p. Ball engine, four 66 in. × 16 in. h. p. steel boilers, one 350 h. p. heater, one 400 h. p. duplex pump, and one injector. This plant will run the new Edison station now being erected there. This firm also started a 100 h. p. Ball engine at Weatherby last week, running Thomson-Houston arc light machines, everything working with the greatest success and satisfaction. In addition to the engine they installed two 100 h. p. steel boilers. On the 5th ult. they shipped one 80 h. p. Ball engine to run the new Brush alternating system at Minersville, Pa., which is now being installed.

The La Roche Electric Works are very busy installing and manufacturing their motors and dynamos. They have five ½ h. p. motors pumping water at Thirtieth street and Broadway, in New York City, and an order for two 1 h. p. motors for pumping gas, from the same city. They report having just completed electric light plants at Parson, Crawford & Co's., 40 lights, and Hageborn & Merz, 30 lights. They have just sold a 150-light dynamo to the Dupont Powder Works, at Wilmington, Del., this being a second order, as they installed a 75-light machine there four months ago. They have also shipped four motors to Paris, and are just now closing a contract with a German syndicate to handle their machines abroad. One of the chief features of their machines for the arc circuit is the automatic cut-off, which takes absolute care of the machine and protects it from all accidents, making burnt-out armatures an impossibility.

The Ball Engine Company, of Erie, Pa., manufacturers of high-speed automatic engines, have made among their late shipments the following: Ionia Electric Light Company, Ionia, Mich., one 100 h. p.; Buffalo Street Railway Company, Buffalo, N. Y., one 150 h. p.; Electric Construction Company, Binghamton, N. Y., three 100 h. p.; Schuyler Electric Company, Yonkers, N. Y., one 125 h. p.; H. M. Sciple & Co., Weatherly, Pa., one 100 h. p.; Bay Ridge Resort Electric R. R. Company, Bay Ridge, Md., one 60 h. p.; Williamette Bridge Street Ry. Company, Portland, Ore., one 80 h. p.; Marion Electric Light Company, Marion, O., one 80 h. p.; Denver Electric Illuminating Company, Denver, Col., one 125 h. p.; Pueblo Light, Heat and Power Company, Pueblo, Col., one 160 h. p.; Metropolitan Street Ry. Company, Portland, Ore., one 85 h. p.; Brooklyn Street Ry. Company, Cleveland, O., three 125 h. p.; Seattle Gas and Electric Light Company, Seattle, Wash. Ter., one 125 h. p; Electric Supply and Construction Company, Seattle, Wash. Ter., 80 h. p.; Edison Electric Illuminating Company, Paterson, N. J., one 150 h. p.; Pendleton Electric Light Company, Pendleton, Ore., one 100 h. p.; Cincinnati Street Ry. Company, Cincinnati, O., two 150 h. p.; Central Passenger Ry. Company, Louisville, Ky., two 150 h. p.

The Novelty Electric Company are erecting an arc light plant in the works of the Chester Pipe and Tube Company, Chester, Pa. This plant consists of two Ball dynamos, which run 30 lights, each of 2,000 c. p. They are also estimating on several other plants of a like nature. In the Pennsylvania Salt Manufacturing Company's works at Natrona, Pa., they have installed a large electric fire-alarm signal system of their own special design, and also three others for the same company in Philadelphia. They have completed Mr. Chas. W. Henry's residence at Wissahickon with a full equipment of electric light and telephone apparatus, and are doing considerable work for Mr. Wetherell, the Corliss engine builder. This firm has also just estimated to furnish a complete outfit of dynamos, storage battery system, etc., for a large insurance building in town. Mr. C. E. Trump, the manager of the company, also showed me their new automatic ventilating apparatus, which is remarkably effective and ingenious. The apparatus is set for any desired temperature, and upon a rise or fall of one degree above or below this the ventilator is automatically opened or shut, as the case may be, by means of a thermometer, which closes an electro-magnetic circuit. Several of these have been placed in the office of the Pennsylvania Railroad Company and the Erie & Western Transportation Company. W. F. C.

Philadelphia, Aug. 24, 1889.

Mr. H. T. Paiste is installing an electric motor for use in manufacturing his well-known switches and incandescent light supplies.

The National Electric Light and Power Company have been so pressed with orders that they have increased the size of their establishment by the addition of the four-story building Nos. 312 and 314 Greene street, giving them an additional floor space of 40 × 60 feet on each floor.

The Electro Dynamic Company are daily running their new storage battery car between Philadelphia and Darby, over what is said to be one of the worst roads in the country. One of the tests is a 7-foot grade for some distance, and the car has recently run through a depth of water, with its water-proof motor, sufficient to cause the passengers to stand up on the seats. The idea of the company is to have their apparatus complete and reliable in every detail before filling the bulk of their orders.

Chester, Pa.—This town enjoys not only the convenience of incandescent street lights, but has the benefit of an automatic signaling device in connection with trains approaching it from the South. A passenger at the depot, waiting for the Northern bound train, is advised of it's approach, long before it is in sight, by the ringing of a large vibrating bell. The next signal is that given by the electric bells in the flagmen's houses; the gates are hardly down before the headlight of the train can be seen coming around the curve, which is such a short distance from the town as to render the electric signaling device absolutely invaluable for the safety of life.

The Thackara Manufacturing Company are doing their best to keep up with their orders for special electroliers, etc. They have secured contracts for the complete wiring of a number of important buildings, both in Philadelphia and elsewhere. Among the recent of these contracts may be mentioned the Young Men's Christian Association of Philadelphia, and Mr Levi P. Morton's apartment house in Washington. An interesting feature in the wiring of the Masonic Temple, of which this company had charge, is the method of distribution adopted, which secures the absolute reliability of the lights. The lights are fed from two different street services, and from each four mains pass up through the building, feeding on each floor from the corners of the rooms towards the centre. Either street service and any two of the mains have a carrying capacity sufficient for all of the lights, so that should one or two mains get in trouble, or either street service give out for any cause, the lights would not be affected. F. R. C.

WESTERN NOTES.

Branch Office of The Electrical World,
39 Mallers Building, Chicago, Aug. 24, 1889.

Mr. George Cutter, Chicago, has secured the agency of the Russell mast arm for the West.

The Pope Glucose Works, St. Louis, are having a Westinghouse incandescent plant installed.

The Northwestern Electric Light and Water Supply Company desire to light Sturgeon Bay, Wis.

Treasurer E. E. Crepin, of the Sperry Electric Company, Chicago, left Paris en route to Switzerland last week.

The Kester Electric Company, of Terre Haute, Ind., are installing a motor plant at the Krause Malt House, Milwaukee, Wis.

The Knapp Electrical Works, Chicago, are building several hundred instruments for the Gray National Telautograph Company.

Force Bain, Chicago, has repaired a number of dynamos injured by the recent flooding of basements during the heavy storms.

Ernst Hoefer, 545 The Rookery, Chicago, has issued a condensed price list of special interest to all electric light and power companies.

Winona, Minn., desires an electric street railway, but the citizens are divided in their opinions regarding the merits of the various systems.

The Charles Munson Belting Company, Chicago, are furnishing some dynamo leather belting to brother Huntley's big station in Buffalo.

Galena, Ill., has gone back into the dark ages, its council deeming gas superior to electricity for street illumination. What's the matter with kerosene?

Charles G. Armstrong succeeds Hugh G. Smiley as sales agent in the Chicago office of the electrical department of the New Haven Clock Company.

W. G. Halm, of the Perkins Electric Lamp Company, and Myron A. Knapp, of the Knapp Electrical Works, Chicago, visited Davenport, Ia., this week.

The Knapp Electrical Works, Chicago, have a perfect dry battery that is very convenient for special work, being only 3-inch ×1½-inch × 1½-inch in size.

Fred Horne, western manager of the Excelsior Electric Company, has sold a 60 arc light plant to the Knapp, Stout & Co., Company at Menominee, Wisconsin.

The National Conduit Company are placing 100 miles of the Dorsett conduit in St. Louis, 60 miles in St. Paul, and have just finished 65 miles in Minneapolis.

New Orleans will shortly have an additional Edison central station, the present one being unable to supply the demand, though operating to its fullest capacity.

Edwin Floyd, purchasing agent of the of the Chicago office of the Thomson-Houston Electric Company, has gone east to join Mrs. Floyd and enjoy a short vacation.

A. B. Cooper, of San Francisco, is in the city endeavoring to form a company to exploit a primary battery said to possess special features of merit in incandescent lighting.

The Taper Sleeve Pulley Works, of Erie, Pa., report having furnished the Watson Paper Mill with a 14-foot fly wheel having a 42-inch face and an 8⅛ inch shaft.

The Scullen Electric Railway Company, S. Louis, have had their work of construction seriously delayed by the wrecking of the freight train containing the necessary material.

The Hill Clutch Works, Cleveland, are furnishing a complete line of shafting and bearings, pulleys and clutch couplings for the Thomson-Houston electric power plant at Atlanta, Ga.

The Babcock & Wilcox Company, Chicago, are furnishing additional boilers to the Edison central station at Kansas City, and to the Consolidated Electric Company, at Denver, Colo.

The Sewickly, Pa., Electric Light Company has been organized, and will furnish both arc and incandescent lights of the Westinghouse system. The plant is now being constructed.

The Johnson Electric Service Company, Milwaukee, Wis., has issued a handsome souvenir containing engravings of various residences containing their heat regulating apparatus.

The Julius Andrae Company, Milwaukee, Wis., are wiring the local residences of Adam Gettelman, J. Oberman and M. Weinstock, and the new residence of J. Brockins, Oconomowoc, Wis.

Logansport, Ind., is enjoying the benefit of the low price lighting that usually follows the introduction of an incandescent system, the price of gas having been reduced to $1.20 per 1,000 feet.

Batavia, Ill., is again agitating the question of city lighting. A plant installed there, or at St. Charles, could probably be operated for the benefit of both towns, as there is an abundance of water power.

Profit and Loss.—A prominent leather belt manufacturer lately remarked that the total amount of losses incurred in his dealings with electric light companies during the past six years did not exceed $250.

Mr. J. W. Taylor, the Chicago representative of the Standard Carbon Company, of Cleveland, will make an extended trip throughout the far West and along the Pacific slope in the interest of his company.

John A. Roebling's Sons Company, Chicago, have issued a convenient price list of the bare and insulated wires manufactured by them for electrical purposes, and showing a telegraph code word for each size of every wire listed.

The Pittsburg, Kans., Electric Light and Railway Company have been granted a franchise, and will commence operations immediately. The franchise calls for the completion of three miles of road by Jan. 1, 1890.

The City of Detroit has already appropriated $140,000 for lighting her streets with electricity, yet the citizens are crying for more light, especially in the suburbs, and the probabilities are that additional arc lights will be placed.

Minor Items.—The Ballou Electric Light Company has been formed at Plattsmouth, Neb., with a capital stock of $30,000. The Citizens' Street Railroad Company, of Decatur, has bought the City Electric Street Railway of that place.

Col. J. H. Shay, Gen. Tucker, W. C. Wonham, J. F. Randall, H. W. Hill and Geo. Okonite Manson were at the Weddell House, Cleveland, last Saturday and Sunday. A new push-button was placed in Room 314 after their departure.

The Anglo-American Storage Battery Company are placing a series of the Sorley cells in the McCormick residence at Lake Forest, and have a large number of cells in use by physicians and surgeons.

The Postal Telegraph Cable Company have about completed their new line between Chicago and Detroit connecting with the Canadian Pacific cable at Windsor. They are also building a new line between Wheeling, W. Va., and Steubenville, Ohio.

Ed. C. Loveland, formerly of Chicago, is now in Trinidad, Col. He writes that the central station plant there consists of four 35 light Thomson-Houston dynamos and two 650-light Thomson-Houston machines, and that the lights give perfect satisfaction.

F. S. Terry, manager of the Electrical Supply Company, Chicago, has proven by actual experiment that a considerable saving in time and ink, to say nothing of the convenience, can be effected in all large houses by using a Rau patent oil can to fill the ink wells.

Mr. George Cutter has sold 15 miles of No. 4 and 12 miles of No. 6 Simplex wire to go to Marquette, and has shipped several dozen Byrant incandescent snap switches. Mr. Cutter says that these switches have given universal satisfaction wherever introduced.

The Electrical Supply Company, Chicago, report large sales of their "high insulation brackets," one company employing the alternating current having used over two thousand of the various styles in order to secure perfect insulation and undisturbed service.

The Duplex-Electric Gas Motor Company, Edwardsville, Ill., has been formed to manufacture steam, gas and electric

engines and appliances; capital, $1,000,000; incorporators, Jay Noble, F. A. Diergin, J. A. Gamersella, A. P. Wolf, J. H. French and W. Halleck Jones.

J. F. Randall, the consulting engineer of Cleveland, states that the Armington & Sims Company had 415 unfilled orders for high-speed engines on their books July 1, and that it has been almost impossible to secure one of their engines of late owing to the unfilled contracts.

The Nebraska City Water and Light Company is enlarging its water plant, and will add an incandescent system to its present arc light plant of the Thomson-Houston system. This company is merely a reorganization of the old City Water Company, of Nebraska, Neb.

The Milwaukee & Lake Superior Telegraph Company, lately incorporated at Milwaukee, Wis., will co-operate with—and will make their lines a continuation of—the Postal Telegraph Cable Company lines to the iron and copper regions of Wisconsin and Michigan.

Wm. Baragwanath & Son have recently shipped a 1,000 h. p. steam heater and purifier for the St. Joseph, Mo., electric street railway plant; also one of the same to the Peoria, Ill., Electric Light Company, and are now building one for the electric plant at Seattle, Washington Ty.

S Taussig, Chicago, has recently secured the contract for supplying 1,000 gallons of Synovial oil to the United States Custom House. This makes the fifth year Mr. Taussig has received this contract, and as there were twelve other bidders, he naturally feels elated over his success.

Minneapolis city officials have been inspecting the police telegraph system devised by Bernard Smith and in use in New Haven, Conn. As at present there are only twenty Ganewell boxes in use, it is the intention of the city authorities to increase the total number of boxes to sixty.

The American Leather Link Belt Company have sold, through their Chicago office, two link belts for the electric plants in Schlesinger & Mayer's dry goods house, and a 16-inch link belt for use in the electric light station of the Chicago & Northwestern Railway Company's city plant.

Arthur H. Brown, representing the Leonard & Izard Company, Chicago, and the United Edison Manufacturing Company, is opening a handsome set of offices in the Mitchell Block, in Cincinnati, and will there extend glad welcome to his friends, all of whom wish him success in whatever he undertakes.

The Sprague Electric Equipment Company, Chicago, commenced work this week on the Central Electric Street Railway plant at Moline, Ill.; also started to work on street railway plant at Sterling, Ill. They have closed contract for plant at Dayton, Ohio, and for additions to plant at Tacoma, Washington.

Andrew Jackson, of Eau Claire, Wis., brought suit on Aug. 21 against the Wisconsin Telegraph Company on unusual grounds for $10,000 damages. Jackson's building was struck by lightning yesterday and burned. He claims the cause was a dead wire of the telephone company which passed over his building.

The English Sparrow.—A brilliant scheme has been devised by an Eastern man to rid the country of the blasted English sparrow. He suggests that bare copper wires be strung in the vicinity of their roosting places and the little bird coaxed to rest thereon, when a current of high potential will be sent along the wires.

The W. C. Vosburgh Manufacturing Company, Chicago, have furnished a handsome electrolier for the new hotel at Anaconda, Mont. It has a handsome cluster of five incandescent bulbs in the centre under a brass cuirass and with twelve lights on the outer circle, all wired for the United States (Weston) system.

President Johnson, of the Cleveland Electric Street Railway Company, entertained a delegation of citizens from Milwaukee, Wis., and one from East Saginaw, Mich., on last Sunday and Monday, who were desirous of seeing an electric system regarding the perfect operation of which so much has been written.

The City of Chicago has purchased the year's supply of coal for electric lighting, etc., at the following rates: 1,000 tons Shawnee lump, $3.19; 1,000 tons large egg anthracite, $5.35; 2,000 tons range anthracite, $5.20; 10,000 tons Indiana block screenings, $1.33; 3,000 Briar Hill bituminous coal, $2.79; 3,000 tons Black horse, $3.75; 175 tons nut, $5.44.

The Root Electric Gas Lighting Company, Chicago, are about to close arrangements giving the exclusive sale of their automatic burner in certain specified territory to some gentlemen who appreciate the advantages to be found in the improved device and foresee the great demand that can be created for so simple and useful a piece of mechanism.

The Thomson-Houston Electric Company have applied for a street railway franchise in Minneapolis and agree to operate outside of the underground-wire district; to give bonds for $50,000 to save the city harmless from damages, and to pay a tax of $25 on each car operated. The company propose to spend $2,000,000 in erecting improvements in the city.

The Pullman Palace Car Company have just shipped twenty-two sleepers to the C. H. & D. R. R. Company, all of which were wired for electric lighting. Electrical Accumulator Company's storage cells will be employed, and the entire work was done under the supervision of A. H. Bauer. These cars had formerly been lighted by the Pintsch gas system.

The Copper Market.—It is reported that the owners of the small copper mines will use every endeavor to raise the price of copper one cent, at least, in the hope of stopping the proposed reduction of two cents, which would necessitate the closing of their mines, as the ore could not be profitably worked at that price. A break in the prices can be looked for, however.

The World's Fair Company of 1892, of Chicago, has been incorporated to hold an international exposition or world's fair in the city of Chicago, to commemorate, on its four hundredth anniversary, the discovery of America. The capital is $5,000,000. De Witt C. Cregier, Ferd. W. Peck, George Schneider, Anthony Seeberger, William C. Seipp, John R. Walsh and E. Nelson Blake are the incorporators.

Charles A. Schieren & Co., through their Western manager, Ernest L. Burrell, Chicago, have sold two 14-inch perforated electric belts to the Elkhart, Ind., Electric Company, two perforated electric belts to the Vierling & McDowell Company, three perforated electric belts to James H. Walker & Co. for service on their electric plant, and a 20-inch perforated electric belt to Thomas & Wentworth, Milwaukee, Wis.

Warrensburg, Mo., has had ample opportunity to learn all about weak points in the various systems during the bitter contest for a franchise for lighting, and later for a street railway system. But the same enterprising spirit that enabled her citizens to secure their handsome court house will probably aid in the selection of the proper system in both cases, and in due time the town may enjoy these proposed improvements.

A New Motor Factory.—Dame rumor says that some Chicago gentlemen are ready to invest $75,000 in a new motor factory to be established in this city. The present agent of a motor company will be the manager of the company, the services of an expert electrician have been secured, and all the plans and drawings of the motor to be made are completed, and the motor has been experimented with during the past year.

The Hatch Lock, invented by A. A. Hatch, of Kansas City, is a device to be used in telegraphy, by means of which all connections with a telegraph wire can be cut off at all intermediate points between the sender and receiver. The patent is equally applicable to telegraph wires and their connections. The invention has been in use on the St. Louis, Fort Scott & Memphis Railway for some time, and has worked successfully.

The Excelsior Electric Company, Chicago, have placed a one h. p. motor in a combined saloon and restaurant on Randolph street to operate a "Baby" ice machine that makes sufficient ice for all the needs of the place at a total saving of over 40 per cent. in the ice bills. The motor is operated by a Thomson-Houston current supplied by the Chicago Arc Light & Power Company, and runs in full view of the passers-by during the entire day.

That Coming Street-Car Motor.—The Pittsburgh *Dispatch* of Aug. 9 says: "The superintendent of the Westinghouse Electric Company, in conversation yesterday, said that they had almost perfected a street-car motor which would surpass anything of the kind in use. While declining to go into details, he claimed that on the score of economy, both in power and construction, it would surpass the cable so far as to leave it out of sight.'

Prof. J. P. Barrett, Chicago's city electrician, served the citizens a good turn when he called the attention of Mayor Cregier to the fact that under the contract made with the West Side Street Railway Company the Washington street tunnel would be closed to pedestrians as well as vehicles, and all wires strung in the passage way would have to be removed. The necessary corrections in the contract were permitted by the railway company.

The Sperry Electric Company report having sold 30 arc lights to Willoughby, Hill & Co., Chicago; 20 arc lights to the Libby Prison Company, Chicago; 30 arc lights to the South Easton Electric Light Company, South Easton, Pa.; a 10 h. p. motor and 75 h. p. in generators for use in connection with coal mining machinery. They also report having been awarded a silver medal and honorable mention for their electrical display at the Paris Exposition.

Club Visitors.—Edwin R. Weeks, President of the National Electric Light Association, and S. S. Leonard, of Minneapolis, were entertained at the Electric Club rooms this week. Among the other visitors from out of town were A. G. McCormack, Ottawa, Ontario; James Montgomery and J. M. Smith, Wausau, Wis.; W. H. Wheeler, Beloit, Wis.; George S. Haddock, Washington, D. C.; W. W. Hazzard, Cleveland; A. S. Baker, Evansville, Wis.

Telephone Quotations.—Col. S. G. Lynch, broker, 146 La Salle street, Chicago, furnishes quotations on telephone stocks as follows:

Chicago	$305@$310	Cumberland	$ 68@ $70
Central Union	58@ 59	Wisconsin	114@ 116
Michigan	84@ 85	Bell of Missouri	150@ 152
Great Southern	32@ 33	Iowa Union	24@ 25
Colorado	36@ 38	Missouri and Kansas	59@ 60
Rocky Mountain Bell	40@ 42		

The Pond Engineering Company, through their Omaha office, will furnish and erect a 250 h. p. Armington & Sims engine for the Sioux City, Iowa, electric light station. They have also contracted with the Laredo Improvement Company, of Laredo, Texas, for an 80 h. p Armington & Sims engine, a 120 h. p. boiler, with the necessary feed pump, heater, injector, etc., for a complete steam plant to be used in running the electric railway in that city.

Foolish Strikers.—The carbon setters of the Alleghany County Electric Light Company, at Pittsburgh, Pa., struck on the 20th inst. for an increase in wages from $1.75 to $2 per day, and on their request being refused endeavored to influence the other employés to join them. But their places were quickly filled with new men, as it was found comparatively easy to secure good carbon men from the smaller towns, where they seldom receive more than $1.25 per day.

The South Dakota Electric Railway Company was organized at Sioux Falls, South Dakota, Aug. 19, with W. R. Kinsbury, president; W. S. Williver, secretary, and C. E. Johnson, treasurer. The company will construct the first electric railroad in Dakota, and will operate between the city and East Sioux Falls, a distance of seven miles. Its capital stock is placed at $100,000, principally owned by New York capitalists. The road will be built immediately.

The Edison Electric Light & Power Company and Erie County Light Company, of Erie, Pa., have a compact, well-built station, and are operating 4,000 Edison lamps and 150 Brush and Thomson-Houston arc lights. Six Ball engines furnish the motive power. A good quality of Alleghany River slack is used, costing $1.30 per ton delivered, while water costs 10 cents per 1,000 gallons. Superintendent Wirt McCreary reports the company in a prosperous condition.

The Thomson-Houston Electric Company have sold through their Chicago office the following list of plants during the past ten days: Baumgartel & Sheridan, Chicago, 100 incandescent lights; Badger Electric Company, Milwaukee, Wis., 350 arc lights, Omaha Smelting Company, Omaha, Neb., 12 arc lights; Springfield, Ill., 650 alternating and 100 arc lights; Billings, Montana, 30 arc lights; Columbus Electric Light and Power Company, 150 arc lights; Houghton, Mich., 100 arc and 1,300 incandescent alternating lights.

The Thomson-Houston Electric Company, through their Chicago office, have sold the following electrical apparatus during the past week: Chicago Arc Light and Power Company, Chicago, 100 arc lights; Knapp, Stout & Co., Menominee, Wis., 650 incandescent, alternating; Redendo Hotel Company, Los Angeles Cal., 800 incandescent, direct; Rhodes & Keese Electric Company, Los Angeles, Cal., 100 incandescent, direct; Riverside Shoe Company, Dixon, Ill., 200 incandescent, direct; A. Schradzki, Peoria, Ill., 12 arc.

The Sherwin-Williams Company, Cleveland, Ohio, have issued a souvenir of remarkable excellence, and containing finely-finished cuts, the details of which appear in handsome relief on the heavy calendered paper. The subject matter is descriptive of a visit through their factory, and reference is made therein to the incandescent electric lighting plant of the Brush system and the Reynolds-Corliss engine employed, also to the watchman's register manufactured by the Cleveland Electrical Manufacturing Company. Altogether it is a book that will always be treasured.

The Pond Engineering Company have secured the contract for furnishing the power plant for running the electric lights of the Libby Prison War Museum, at Chicago. The old Libby Prison has been removed from Richmond and set up in Chicago, all the prominent brick and stone being marked, and placed as originally in the building at Richmond. It will be lighted by 600 Edison incandescent lights and 20 Sperry lights, the dynamos being driven by a 90 h. p. Armington & Sims engine. The Pond Engineering Company will have the plant installed by Sept. 1.

The Franklin Electric Company, Chicago, are operating some nine different machines with a 1 h. p. C. & C. motor of 220 volts, operating on the Edison circuit. This company make a specialty of cutting zincs to order for battery purposes, and are enjoying quite a trade in that line, as the number of experimenters in primary batteries is countless.

The Railway Automatic Danger Signal Company has been incorporated at Chicago for the construction and sale of the automatic danger signals for railways made under the patents granted to James W. Steele. The apparatus at present is entirely mechanical in its action, but will shortly contain electrical features of some importance. The system includes the dropping of a semaphore in the event of a burning of a railway bridge or of the structure being moved by reason of high water, or injured in any way through other causes. The capital stock is $250,000, and the incorporators are James W. Steele, N. C. Gridley and David H. Fletcher.

The Chicago Telephone Company are placing several miles of the Camp and Thompson delft ware conduit in the centre of the streets, commencing at the telephone building and running to the alley north of Lake street, through same to the tunnel and by way of Kinzie and Clark streets to the Chicago avenue station. The Southern extension follows Franklin street to Van Buren, to Fifth avenue, to Harrison, to Victoria alley, where connection is made with the pole line. Seven tiers of piping are to be laid, each pipe having two ducts, the total capacity of all the ducts being sufficient to carry 6,500 wires in cable form, made according to the new specification, and affording a complete metallic circuit.

Gas Engines.—A 20 h. p. Otto gas engine is employed at Iowa City, Ia., to drive a forty arc light Western Electric dynamo, from which only sixteen lamps are now being operated for street lights on a three-mile circuit. As soon as the number of lights is increased an additional 20 h. p. gas engine will be installed. The Racine Gas Company are now employing two Otto gas engines, one of 15 h. p., the other of 50 h. p., to drive a special wound No. 8 Brush dynamo, operating sixty-two 2,000 c. p. lights on an eleven-mile circuit. On a total run of 955 lamp hours the expenditure of gas was at the rate of 23½ cubic feet per lamp hour. The Grand Forks, Dak., Gas Company are now installing a 20 h. p. and a 50 h. p. Otto engine to drive a mixed arc and incandescent electric plant.

Special Illumination.—There are two or three occasions each year when city councils are apt to appropriate certain sums of money for the illumination of the streets, and heretofore this work has generally been done by the local gas companies. But the tendency in progressive towns is to have the arc light suspended at frequent intervals across the street, the globes being of various colors, and to have suitable devices made of colored incandescent bulbs placed at various points. It is to be hoped that Minneapolis will devote the $5,000 lately appropriated for special illumination during the exposition to showing her citizens what a magnificent effect can be secured by the use of electricity in the place of the yellow, sickly-looking gas jets.

The Chicago, Rock Island & Pacific and the Lake Shore & Michigan Southern railway companies secured an injunction from the Circuit Court restraining the Chicago Telephone Company from constructing, digging, or extending its conduits across the right of way and under the tracks of the complainants on Harrison street, and from entering, obstructing, or in any way interfering with the companies' right of way on Harrison street, until it has established its right to do so by condemnation proceedings. The railroads filed a bill in which they say the telephone company is proceeding to disturb its right of way without allowing for an opportunity to ascertain the damages the railways may suffer. The complainants gave an injunction bond of $3,000.

The Cleveland, O., Electric Light Company are making quite an addition to their plant, which had long ago outgrown its present quarters. A two-story brick extension to the building is being erected as rapidly as possible, and, when completed, will be occupied by the office force, and two new 1,300-light Thomson-Houston alternating machines and several new arc light dynamos of the same system. A new Corliss engine will be added, requiring a double leather belt 94 feet in length by 40 inches in width, which will be furnished by the Charles Munson Belting Company, Chicago. This belt will run to a line of shafting and clutch pulleys now being constructed by the Hill Clutch Pulley Company, of Cleveland. These additions will make the station one of the best in the State.

The Electrical Supply Company, 171 Randolph street, Chicago, which is the Western branch of the Electrical Supply Company, Ansonia, Conn., have recently been making valuable improvements throughout their entire line of electric bells. All of their old stock has been disposed of, and they now offer the electrical house goods trade a line of bells made in the best possible manner and at prices at which no one who values quality above cost can complain. Their wood box, iron box and skeleton bells are made on a new system in the best and strongest manner, and are all carefully adjusted by an experienced electrician before they leave the factory. The company cordially invite correspondence from all electricians, feeling assured that a trial of their improved bells will be all that is required to make them generally popular.

The World's Fair will be held in Chicago in 1892. Meetings of the various committees have been held during the past week, but none were of a more interesting character than the spontaneous gathering of nearly 600 employés of the Western Electric Company in the courtyard of their works on South Clinton street, at noon time, Tuesday, Aug. 20. After suitable remarks had been made regarding the advisability of holding the World's Fair in Chicago, the following resolutions were adopted: "*Resolved*, That we heartily approve of the effort now being made in every branch of business to secure the World's Exposition in 1892 in Chicago; *Resolved*, That, in our judgment, to secure the end desired will require the hearty co-operation of every man in Chicago. *Resolved*, That as employés of the Western Electric Company we pledge to the Finance Committee our full proportion of subscriptions to the capital stock, and recommend that every interest be promptly organized." This remarkable outburst of enthusiasm on the part of the men will be of great value in spurring other organizations on to similar efforts, and inspiring individual efforts among the working classes and their employers.

Insulated Line Wires.—The Western Branch of the Electrical Supply Company, 171 Randolph street, have recently issued a handsome and complete little volume and price list of their insulated line wires. The sales of wires manufactured by this company have increased to such an extent that they deemed it best to give a special list of wires they manufacture and handle, for the benefit of all those interested in electrical matters. The company have recently manufactured and placed upon the market a new line wire of very high insulation which they have named "Shield" Brand, and which they fully describe in this new special price list No. 582. The claims made for the "Shield" brand wires, cover all the requirements of electric light installation. They also give a list of their catalogues, and new circulars of their latest goods, as well as

a carefully compiled table of dimensions and resistances of pure copper wire. The book as a whole, is neatly printed on heavy paper and bound in a handsome cover of leatherette. It will be cheerfully sent by the Electrical Supply Company, to any one interested in electrical matters, upon application. It will be found a great convenience to all those interested in electrical construction of any kind.

The "Shield" Brand of Wire.—Experience has taught the owners of electric light and power plants that only "the best is the cheapest," and that expenditure for material of a low grade purchased because the price is correspondingly low, is money thrown away, Thus to day no sensible owner of a plant thinks of using underwriters' wire if it is possible to secure a weatherproof insulation or something better, knowing that the slight additional cost will be more than made up in the improved service secured. One of the best of these weatherproof wires is the Shield brand which has been on the market only a short time, but has been thoroughly tested during the past fifteen months. The Electrical Supply Company report that their factory is running overtime in the endeavor to keep up with the orders for this new line wire.

Hooley's Theatre, Chicago, is the latest addition to the large number of amusement resorts that have adopted the electric incandescent light in preference to gas on account of the impossibility of danger from open flame, greater illumination, more perfect regulation and the absence of a heated and impure vitiated atmosphere. To-night 800 Edison incandescent lights will be turned on and regulated from the stage, the current being supplied from the Chicago Edison Company's central station on Adams street. Forty bulbs have been placed at the edge of the stage for foot lights and 175 bulbs as border lights. These lamps, of 110 volts, are placed in series of two each and wired for a current of 220 volts, thus doing away with the neutral wire and effecting a saving in the number of resistance boxes, as a separate resistance box is used on each regular circuit. From the centre of the dome hangs a double circle containing 50 lamps, while projecting from the front of the balconies numerous bulbs are placed at short intervals. Handsome combination fixtures are placed in the lobbies and near the stairways, while group lights illuminate the boxes. For part of the work okonite wire was used and kerite wire for the remainder. The resistance boxes, regulating switches, etc., are all fire proof. The work was designed by and done under the supervision of Mr. L. A. Ferguson and Mr. J. H. Goehst, of the Chicago Edison Company.

Suburban Street Railways at Pittsburgh, Pa., have been incorporated as follows:

The Bloomfie'd and Shadyside Railway, capital $30,000; H. S. A. Stewart, John G. Holmes, Geo. Rice, Geo. C. Wilson and Wm. R. Holmes, all of Pittsburgh, incorporators. The Forbes Street and Park Avenue Passenger Railway, capital $12,000; James P. Speer H. S. A. Stewart, Edward House, John F. Steel, R. J. Coyle, Jr., and Robert S. Frazer incorporators. The Wilkins Avenue Railway Company, same capital and same incorporators as above. Its route is to be on Fifth, Wilkins and Shady avenues to Forward street. The Homewood Avenue Railway Company, same capital and same incorporators. Route along Homewood avenue, from Forbes street to Pennsylvania Railroad. The Frankstown Railway Company, capital $30,000; incorporators, John G. Holmes, H. S. A. Stewart, George Rice, George C. Wilson and William R. Holmes. The Forbes Street and Shady Avenue Railway Company, capital $12,000, and incorporators the same as of the Bloomfield Company. Route over Forbes and Craig streets and Shady avenue. The Braddock Street Railway Company, capital $80,000; incorporators, A. W. Mellon, Pittsburgh; M. F. McCook and John Kelly, Swissvale; A. F. Brackinger, Braddock; W. Mitchells and Laurie Child Allegheny. Route from Rankin Station to Turtle Creek.

The D. M. Steward Manufacturing Company, Chattanooga, are meeting with unparalleled success in their patent lava insulators, being crowded beyond their capacity. They are adding machinery and tools as rapidly as they can be made for their specialties. They are at work on large orders for Edison, Thomson-Houston, Sperry Electric Company, Heisler, Western Electric Company, Forcé Bain, Standard Thermometer Company and many others. Their strong point is the absolute safety from arcing or short circuits wherever their insulators are used. This is especially true in very small pieces requiring great accuracy in fitting, as their material is frequently made up in pieces requiring a fit to 1-1000th of an inch. It is well known that rubber, fibre, and any composition, in fact, other than lava, burns at a comparatively low heat, or carbonizes, losing its value as an insulator. A number of the new compounds used for insulating have been tested at the works recently. Some of them softened in the hot sun, others, a little better, took fire from a burning match, and none, except lava, stood the electric arc. It will stand any exposure to moisture, heat or cold. One of the strongest indorsements that could be given it is the size of the orders—for example, 110,000 pieces in one week from the Thomson-Houston Company, who have ordered 205,000 pieces in a single order. The Edison orders, too, run away up in the figures, to say nothing of scores of smaller manufacturers who know a good thing when they see it. Much of the success of "lava" is attributed to advertising in THE ELECTRICAL WORLD. F. DE L.

MILWAUKEE, Wis., August 21, 1889.

The Edison Company.—Charles F. Ilsley, Charles Ray and D. M. Benjamin have incorporated the Edison Electric Illuminating Company with a capital stock of $500,000.

The Badger Electric Light Company has begun laying its underground wires from Grand avenue south on West Water street to the Menominee bridge, and from all West side streets running east and west to points on Sixth street.

Green Bay, Wis.—The Thomson-Houston Electric Supply Company has made application for a franchise to build and operate an electric street railway. H. Burkholder has made a similar application for a horse road. The electric system is generally favored.

The Police Department Telephone Operator at Milwaukee makes 1,500 connections to receive reports from patrolmen stationed all over the city, besides answering hundreds of calls daily upon various matters pertaining to the police department. About the same number of calls are responded to by the night operator, and all this telephone business is transacted by two operators.

Thomas H. Dempsey, of the Seattle *Times*, while in Milwaukee recently said: "Seattle is far ahead of the East on the street railway question. We did away with horses nearly a year ago, and now have twelve miles of cable line similar to the famous one in San Francisco, with six more miles in course of construction. There are also ten miles of Thomson-Houston overhead electric railway, and an extension ten miles further will be finished by the time I get home. It has worked magnificently. For several miles it runs parallel to the cable line, and is better patronized, our people preferring it. If you get a road of that kind here, you will find that within a short time all the other lines will be asking leave to put in a similar system. There is a line of that kind seventeen miles long, between Omaha and Council Bluffs, and it is a perfect success. I regards it as superior to either elevated or cable roads. Our line was only stopped three days by the great fire, and then the poles and lines were up again, with cars running among the ashes."

W. M. G.

SALT LAKE CITY, Utah, Aug. 14, 1889.

The Union Passenger Depot at Ogden, Utah, was opened for general traffic on the 1st inst. On the night of the 31st the premises were opened by the officials of the road, political leaders and citizens of the surrounding Territories with a grand ban and ball. The building and yards were brilliantly illuminated by Edison light supplied from their own isolated plant erected in the annex building for the purpose. The station is of 500 lamps capacity, a model plant throughout, and it is regarded as an evidence of enterprise and progressive ideas on the part of the Union Pacific Railway. In addition to the usual interior and exterior lighting, one incandescent lamp is supplied in each switch-stand throughout the yards. The electrical equipment for this institution was placed by the agent for the Edison Company, R. M. Jones. So far it has proved a thorough success.

The Salt Lake Street Railway Company made their first trial trips with electric cars on the 8th inst. All parts of the system proved to be in perfect order, and the working of the cars, stations and system generally proved successful, The company has ten new Stephenson 16-foot cars, eight of which are equipped with one new type 15 h. p. Sprague motor each, and two cars have two 15 h. p. motors each. The station equipment consists of one Fraser & Chalmers' compound tandem Corliss engine, 18 and 28 inches by 48 inches, and two Edison dynamos, No. 32 capacity, 80,000 volts each, driven at 500 volts. On the track 4½ miles of the equipment is completed and nine miles will be in operation by Sept. 1. The road will probably be extended to 20 miles equipment and 20 to 30 cars, as soon as such construction can be completed. The electrical equipment of this road and station is being done by R. M. Jones, the Sprague Company's agent for Wyoming and Utah. F. P. Lewis is seeing to the car equipment and giving instructions to the new drivers.

CANADIAN NOTES.

WINNIPEG, Aug. 14, 1889.

Telephone.—The Winnipeg Telephone Exchange has now reached the substantial number of seven hundred subscribers. This showing in a city of 25,000 inhabitants is at once an indication of the business enterprise of the citizens, and the efficient service afforded by the popular manager, Mr. F. G. Walsh.

Incandescent Light in Winnipeg.—The Northwest Electric Company, Ltd., has been formed with a capital stock of $100,000 for the purpose of introducing the Edison incandescent light and power system. Their central station, a substantial and commodious brick building, is rapidly approaching completion. and will have an ultimate capacity of 6,000 lights. The company expect to commence operations about the middle of October, with an installation of 3,000 lights, the greater part of which will be supplied on the meter system. W.

ENGLISH NOTES.

[*From Our Own Correspondent.*]

LONDON, August 14, 1889.

The Naval Manœuvres.—Our naval manœuvres, which promise to become an interesting annual institution, seldom pass by without one of the many naval applications of electricity being tested on a practical scale. This year signaling by lamp-flashes in Morse code between the ships and the land is to be extensively employed, and the Admiralty have organized a complete system of telegraphic communication between the land signal stations and the nearest naval and military centres, in order that prompt information may be given of the approach of the enemy.

The Proposed Standardizing Laboratory.—Since the deputation to the president of the Board of Trade a few weeks back, the proposed Government Standardizing Laboratory has hung fire. The Treasury evidently labors under the impression that it is asked to devote a large sum of money to carry out the hobby of a few faddists, instead of, as is the case, to make provision for the carrying out of the electric lighting acts of 1882 and 1888, which insist that every consumer *shall* have a certified meter. It is very much to be regretted that there should be any misunderstanding about this question, which, unless it is speedily settled, promises to bring matters to a complete deadlock, as several thousands of meters are waiting to be certificated, and no machinery is available to do it by. The laboratory would probably very soon yield a handsome revenue to the State, and would enable English instrument makers to hold their own with foreign competitors, who are at present in a position to get their ammeters, voltmeters and other apparatus tested by government, and enhanced in value by an official certificate. I think that if the paying possibilities of the proposed laboratory were more strongly insisted on, there would be greater willingness on the part of the government to undertake the work.

The London Electric Supply Corporation.—At a recent meeting of the London Electric Supply Corporation, the chairman, Lord Crawford, gave some interesting facts with regard to the progress of the Deptford central station. A building covering an area of 40,000 square feet has been run up, boilers to the extent of 12,000 h. p. have been erected and tested, and two 1,500 h. p. engines are ready to begin work, and as soon as the dynamos are ready, which will be the case within the next few weeks, the Deptford station will be in a position to relieve the Grosvenor Gallery of 16,000 lights. The 10,000 h. p. dynamos, of which we have heard so much, are still building, and the engines intended to drive them are awaiting their completion. Perhaps the most important statement made by the chairman was that relating to the erection of another station. It will be remembered that the Electric Supply Corporation have throughout laid great stress upon the advantages of having the single, large, compact generating station. It will also, perhaps, be remembered that during the Board of Trade inquiry into the Metropolitan schemes, the works of the corporation were inspected by the Board of Trade inspector, Major Marindin, and that during his visit, and in close proximity to the inspector himself, a large steam pipe burst, resulting in the death of an unfortunate workman. Whether or not this untoward accident had anything to do with it, I do not profess to know, but at any rate the inspector, in his report, recommended the Board of Trade to insist upon a thorough subdivision of the Deptford station. The outcome of this is that the Electric Supply Corporation have decided to erect a second station in another locality, and have in this way justified the warnings of those who doubted the expediency of putting so much plant into a single building.

The Birmingham Exhibition.—The Electrical and Industrial Exhibition at Bingley Hall, Birmingham, was opened with much ceremony on Thursday last by Lady Randolph Churchill, and seems likely to prove a decided success. The industrial portion of the exhibits, owing probably to the backward state of the electrical exhibits is, however, unduly prominent. The lighting, which comprises 80 arcs and several hundred incandescents has been carried out in a very thorough manner by the Anglo-American Brush Corporation, the Thomson-Houston Company, the Planet Electrical Engineering Company, Scott, Ernest & Co., of Newcastle, and Elwell Parker. The Brush are running their lamps in parallel off a 100-volt Mordey transformer, each lamp having an impedance coil in series with it. The "Alpha" arc lamp, used by the Planet Company, is of a new type, a small motor being employed in lieu of the usual solenoids. The Brush Company show, among other things, a 2,000-volt Mordey alternator driving another Mordey alternator as a motor, the latter driving a large "Victoria" incandescent dynamo. The United Electrical Engineering Company have in operation a telpher line, and Messrs. Laing, Wharton & Down exhibit the Thomson welding apparatus. The number of electrical novelties is, as was to be expected, comparatively small. A new thing in minor apparatus is Snelgrove's electric balance, which records the exact weight on a dial. The display of cables is very good, comprising a large variety of the concentric and lead-covered type. The E. P. S. Company, the Edison-Swan Company, Messrs. Woodhouse & Rawson, and a large number of minor firms exhibit, and the display of motors by Messrs. Immisch & Co. and Messrs. Lawrence, Paris & Scott is very striking. So that the exhibition, if not of first-rate importance from the electrical engineer's point of view, will prove a great attraction to the general public, and thus indirectly benefit the industry. As you are probably aware, a similar exhibition is to take place next year at Edinburgh, where a very successful exhibition was held in 1886.

The Manchester City Council and the Electric Light.—An important discussion which took place at the Manchester City Council last week opportunely illustrates one very formidable difficulty which has to be encountered in attempting to introduce the electric light on a large scale into the great commercial and manufacturing centres of this country. Many of these places, like the city just referred to, supply their own gas, and, like Manchester, regard the intrusion of the new illuminant as jeopardizing public money which has been invested in the old. This consideration is equally serious whether the local authorities, who are also gas purveyors, propose to supply electricity themselves or to permit private companies to undertake the task In the former case, the success of electricity would extinguish the gas works, and in the latter the success of the companies would not merely ruin the gas business of the local authorities, but would divert all the profits of public lighting to the pockets of private undertakers. No wonder that the City and Town Councils are at their wits' end to know what to do in these circumstances. They would certainly do nothing did the law permit them; but the terms of the Electric Lighting Act stipulate that applications for provisional orders—which are to be lodged before a certain date—can be effectually opposed only by such local authorities as are seeking provisional orders themselves, and who are bound, as are private undertakings, to supply the inhabitants with electricity on demand within a period of three years. This, therefore, is the dilemma which was discussed at Manchester last Wednesday. Either the city council had to accept the responsibility of a provisional order, or run the risk of seeing the city lighting distributed among the four or five private companies who have applied for provisional orders. Their decision was made more difficult by the circumstance that most of the council were convinced that the business would not be profitable, and that, therefore, if they entered upon it a large amount of rate-payers' money would be wasted. In the end, however, this contingency was faced rather than the alternative of unrestricted competition, and application for a provisional order covering the Manchester area is at once to be made by the city council. Its example will no doubt be followed elsewhere and as, in most instances, the Board of Trade will favor the local authorities, the result will be that the electric light will nowhere be introduced hurriedly, but more probably kept out as long as the law will permit. Of course these remarks do not apply to the metropolis, where the numerous bodies of local authorities which have ruled it until recently have never embarked in the business of water or gas supply.

PARIS NOTES.

(*From Our Own Correspondent.*)

PARIS, France, Aug. 7, 1889.

The Sprague Electric Railway & Motor Company have made a very interesting display at the Paris Exposition. Situated in the railway section of the Palais des Machines, it is on the same line of track as the Pennsylvania Railroad exhibit. As was remarked by Mr. W. C. Bailey, the agent of the Sprague interests here, they have done their best to counterbalance the discouraging effects of the exhibit of the largest railroad corporation in the United States and the new world, and their success is gratifying. It does indeed seem strange that where it was deemed worth while making an exhibit at all, that the railroad company of the Keystone State should send over a few small sections of freight and passenger cars of the most ordinary kind, with some broken castings of wheels, etc., making a display which is a constant source of chagrin to Americans, and of laughter and derision on the part of neighborly strangers. It would have been far better if our railway systems had not been represented at all, than to be represented in such a manner as to be a reproach. It is hard to understand how this happened, unless it was that our commission did not represent the case as it should have done to the proper authorities. On the further side of the American passenger coach is a space in which the Sprague motor reigns supreme. Here is to be found the very latest type of car truck, supplied with two 15 h. p. motors of the water-proof variety, with the field-magnets incased in such a manner as to be absolutely protected from accident. These motors are mounted on flexible suspensions, so as not to be injured by jar, etc. All the bearings are rendered dust-proof by being shut up in a specially-made box. The machines are fitted with the new carbon brushes, which are so adjusted as to permit the armature to run in either direction without changing their position.

Current is supplied to the motors at a pressure of about 130 volts, and as the whole truck, wheels and all, is raised from the track several inches, the machines are in motion without the truck moving backward or forward. One is surprised at the noiseless running of the machinery at high speeds, and as the various characteristics are pointed out, the faith of the listener in electric railroading is largely increased, and he feels that electricity is indeed *the* power of the very near future.

The Sprague exhibit is effectively draped and decorated with bunting and an abundance of fine photographs of the many roads this company has already installed in such a large number of our cities and towns, together with very interesting statistics relative to the transmission of power from central stations. The Sprague display as a whole is a praiseworthy exhibition of the latest development of electrical transmission in America, and as such deserves all the attention it is attracting. E. W. H.

NEW ZEALAND NOTES.

DUNEDIN, July 10, 1889.

The City of Wellington is now ready to be lit by an arc light plant. As soon as the water power is complete the installation will be put into regular operation.

Dunedin Street Cars.—The Dunedin City Tramway Company have had an offer under consideration to dispense with horses and substitute electric cars, using overhead connection. They would effect a saving of $17,500 a year, and only the want of capital prevents them from closing with the offer and making the initial change. E. J. F.

THE TELEGRAPH.

Chokee, Ga. - A telegraph line is to be built by Mr. A. Simmons.

Police Telegraphers in New York are asking that their pay may be increased to $1,500 a year. They work hard in responsible positions and deserve the money. There are five operators at police headquarters.

The Auxiliary Fire Protective Company has been formed at Chicago to lease and place in residences, offices, etc., auxiliary boxes, having immediate connection, electrically, with the street fire alarm boxes of the municipal fire alarm. Capital stock, $600,000; incorporators, Rollin M. Squire, U. W. Weston and James J. Hoyt.

The Old Timers' Reunion.—The ninth reunion of the Old Time Telegraphers' Association and the United States Military Telegraph Corps will be held at Louisville, on Sept. 11, 12 and 13, with headquarters at the Louisville Hotel. The programme includes a trip to the Mammoth Cave, to which a whole day will be given up. Full particulars can be had from Secretary W. J. Dealy, at the Western Union office, 195 Broadway. Chas. Smith, Western Union manager at Louisville, is chairman of the committee of arrangements.

THE TELEPHONE.

Beverly, W. Va.—The Tygart's Valley Telephone Company has been formed by J. L. Walmsley, B. L. Butcher and others.

The Central Kentucky Telephone Company has been formed at Danville by L. Eddy, S. Lyons and J. W. Proctor with a capital stock of $10,000.

The Troy Telephone Company, of Troy, Ala., has been formed to operate an exchange. Mr. J. F. Cowart is President, and J. B. Wiley is Secretary.

Wong Hong Tai is the name of a Chinaman in San Francisco who is credited with operating in Chinatown a telegraph and telephone system with 16 stations scattered over 6 miles of circuit. He is also said to have made all his instruments himself, regardless of patents, and to have embodied several new ideas in them.

The Phonograph in New Mexico.—The Hillsboro (N. M. *Advocate* says: A phonograph has been ordered which will be used in taking down the testimony in the case of M. A. W. Park et al. vs. Robert H. Hooper, which is now going on before a special master here. The phonograph will receive the evidence during the morning and repeat it to the typewriters in the afternoons and evenings.

THE ELECTRIC LIGHT.

Elkins, W. Va.—An electric light plant is wanted.

Franklin, Tenn., proposes to put in a plant of its own.

Paris, Tex.—The City Council want estimates on a plant.

Brinkley, Ark.—The Brinkley Car Works will put in an electric light plant.

Grafton, W. Va.—A Westinghouse plant to be put in, to cost, it is said, $50,000.

Biloxi, Miss.—Mr. P. J. Montrose proposes to put an electric light plant in his new hotel.

Earlington, S. C.—Mr. J. C. Wilcox is interested in a movement to put in electric lights.

Berkeley, Cal., will soon issue bonds for $30,000 for the purchase of an electric light plant.

The Monroe, La., Electric Light and Power Company will add an incandescent plant.

Union, S. C.—The Union Oil and Manufacturing Company want a 50-light incandescent plant.

Brownsville, Tex.—Mr. H. F. Gray, of Galveston, wants bids on a 1,000-light plant for Brownsville.

The Gloversville, N. Y., Electric Company has been formed with a capital stock of $60,000.

Madison, Ga.—The Georgia Farmers' Oil and Fertilizer Company is in the market for an incandescent plant.

Abingdon, Va.—The Abingdon Water Company have contracted for a plant of the Edison municipal system.

The Meridian Electric Lighting Company are endeavoring to secure permission to erect poles, etc., from the Pittsburgh, Pa., city council.

Mobile, Ala.—The Alabama Gas, Electric Light and Power Company have been granted a franchise to erect gas works and an electric light plant.

Terrell, Tex.—The Terrell Electric Light and Power Company has been formed by J. Orr and others. It will start with about 20 arcs and 750 incandescents.

Berkeley Springs, W. Va.—The Berkeley Springs Manufacturing and Improvement Company is to be formed to erect an electric light plant and water works.

Manchester, Ia.—Hoag's flouring mill was destroyed by fire on Aug 24, and with it went the electric light plant. The total loss is $25,000 to $30,000, without insurance.

Covington, Ky.—The Citizens' Electric Light and Power Company, with a capital stock of $60,000, has been formed by A. M. Worthington, W. F. Hays, John R. Coppin and A. Stewart.

Grafton, W. Va.—The Grafton Gas and Electric Light Company, incorporated by J. T. McGraw, J. F. Legge and others, with a capital stock of $50,000 will put in Westinghouse apparatus.

Berkeley Springs, W. Va.—The Berkeley Springs Improvement and Manufacturing Company has a capital stock of $50,000 part of which will be devoted to an electric light plant.

Canton, Mass.—There is a lively fight at Canton, Mass., between local Thomson-Houston and Westinghouse companies for town lighting. The Supreme Court has been asked to intervene.

The Wilson Incandescent Light Company has been formed at Portland, Me., with a capital stock of $800,000. Mr. J. Prescott, of Arlington, Mass., is president; C. M. Reed, of Boston, is treasurer.

Charleston, W. Va.—The Charleston Electric Heat, Light and Power Company has been incorporated by A. Broch, J. A. H. Adams and others, of Wheeling, and Hon. C. P. Snyder. The capital stock is $200,000.

Holyoke, Mass.—Roland T. Oakes & Company have the contract for putting in 213 incandescent lights in the Holyoke House, and are also to do the construction work on 600 incandescent lights for the works of the Far Alpaca Company.

Middlesborough, Ky.—The Orient Electric, Water and Gas Company have signed a contract with the Middlesborough Town Company to build an electric light plant, water works, gas works and an ice factory. The electric light plant will be put in at once, and the water works are to be completed by January, 1890.

Reno, Nev.—The Pacific Electrical Storage Company, through Mr. F. Reckenzaun, its electrician, has put in a storage plant at the State Insane Asylum of 100 lights capacity. The dynamo is run by the Truckee River, or by steam engine when necessary. The plant is greatly admired. There was a procession in the asylum when it started.

Cost of Coal for Arc Lights.—A correspondent writes us as follows: "In reference to an inquiry in regard to the cost of coal to operate arc lights of 2,000 c. p., I would say that for the last month, running 6 hours a day and 6 days per week, 25 tons of pea coal were consumed to run 77 lamps. A safe estimate for the cost of coal is from three-fifths to 1 cent per hour per horse-power in and around Philadelphia, where good steaming coal costs $3.50 per ton."

Middlesborough, Ky.—The Orient Electric Company, of Boston, Mass., lately mentioned as to build an electric light plant, water works, gas works and ice factory, have organized the Middlesborough Water, Light and Power Company; capital stock $250,000, to erect the plants. Contract for electric plant has been given to the Thomson-Houston Electric Company, of Boston. Contract for building, 40x90 feet, has been let to M. J. Eastman. J. H. Mead is manager.—*Mfrs. Record.*

The Pond Engineering Company will furnish the Capitol building, Austin, Texas, a 70 h. p. Armington & Sims engine, and a 70 h. p. boiler, to be used in running the electric light station. They are furnishing the Western Engineering Company, of Omaha, Neb., with some Ireson leather link belting, and the Pine Bluff, Ark., Water, Light and Power Company with a vertical boiler and a Tracy patent oil filter. Their sales of books on engineering topics for the past week has been very large.

The Sioux City, Iowa, Electric Light and Gas Company, successors to the Sioux City Electric Company, have sold the grounds and buildings occupied by the old company, and are erecting a handsome station, near the gas works, to be of brick, 150 feet by 50 feet. As soon as completed, the company will be able to furnish current for 1,450 16 c. p. Westinghouse incandescent lamps, and 210 arc lamps of the Thomson-Houston system. Buckeye, Armington & Sims and Corliss engines will be used. Mr. L. L. Kellogg is the general manager of the company, and T. H. Leary, superintendent and electrician.

Meridian, Miss.—The Thomson-Houston Electric Light and Power Company have just closed a contract with the Western parent office for one 50-light Thomson-Houston arc machine, and one 25-light, and for 75 lamps of 2,000 c. p., making a total with their present system of 145 arcs. They have also bought from the Taylor Manufacturing Company, of Chambersburg, Pa., a 90 h. p. Peck automatic engine and boiler, making 180 h. p. in all. They have increased their capital stock to $30,000. In 60 days they will be operating 35 street lights and 110 commercial. Mr. C. C. Broome is superintendent, Mr. W. L. Fewell secretary and treasurer, and Capt. J. W. Fewell, president.

Washington, D. C.—The Westinghouse Company are about to erect a plant in Washington, embracing that portion of the city from K and First streets north to the boundary and Twenty-sixth street. This includes the finest portion of the city, in which the foreign embassies and the finest residences are located. The conduits are to be manufactured by the National Conduit Company, the cables by the Standard Underground Cable Company. Westinghouse engines and the Westinghouse system of incandescent lighting will be used. The work is to be finished by Dec. 1. C. H. Jackson, of Pittsburgh, is president of the company, and James Atwell has had charge of the negotiations.

Southern Notes.—Mr. F. Ridden is president of a company formed at Fort Payne, Ala., to put in a plant of 50 arcs and 1,000 incandescents.—The Evergreen (Ala.) Hotel and Improvement Company will buy an electric light outfit.—Mr. McDougall is putting in a $30,000 plant at Denison, Tex.—Mr. G. J. Bayless, of the Western Electric Company, has contracted to furnish a plant for Victoria, Tex.—The Birmingham (Ala.) Union Railway Company have asked for a permit to operate any or all of their roads by electricity.—The De Leon (Fla.) Springs Company propose to put in an electric light plant to be run by a rapid stream of water.—The Milledgeville (Ga.) Oil Mill and Fertilizer Company will put in an electric light plant.—Frankfort, Ky., is to have an electric road.—The Union Railway Company, of Chattanooga, propose using the storage battery system.—S. B. Elkins and associates are to put in an electric light plant at Elkins, W. Va.—F. B. Arendell and others have bought a controlling interest in the Salisbury Gas Company, and will probably put in an electric light plant.—High Point, N. C., Mr E. D. Steele, mayor, with population of 3,000, offers inducements for a company to put in a plant.—The D. A. Tompkins Company, of Charlotte, N. C., will put in an arc and incandescent apparatus for the Sumter Electric Light Company.

APPLICATIONS OF POWER.

Laredo, Tex.—The Laredo Improvement Company will have a Sprague road.

Savannah, Ga.—The City and Suburban Railway Company are now selecting an electric system.

Nashville, Tenn.—The City Electric Railway Company are in the market for engines, boilers and cars.

Macon, Ga.—Mr. G. F. Work is to spend $35,000 on electrical equipment for the Macon Street Railway.

Marshall, Tex.—The Fort Worth Construction Company will build an electric street railroad in the fall.

Providence, R. I.—The Union Railroad Company is understood to be going in for the Julien Storage system.

Crawfordsville, Ind.—A company is being formed by Major Ellston and others to build and run an electric street railway.

Memphis, Tenn.—It is reported that parties will purchase the Prospect Park & Belt Railway, and operate by electricity.

Richmond, Va.—The Shockoe Hill and Union Depot Passenger Railway Company have obtained a franchise to build an electric railroad.

Houston, Tex.—The Houston Belt & Magnolia Park Railway Company are to raise money, by mortgage, for an electrical equipment.

Ottawa, Ill.—The Ottawa Electric Street Railway Company started its electric service satisfactorily on Aug. 15 with 8 cars running over 6 miles of track.

Knoxville, Tenn.—W. G. McAdoo, Jr., of Chattanooga, and others, have bought control of about 12 miles of road, and will operate the whole by electricity.

Chattanooga, Tenn.—C. A. Hyerly, E. Watkins and S. W. Divine will put in the Sprague system on the City Street Railway Company. They own 21 miles of road.

The Perret Motor is meeting with ready sale in New Orleans, twelve outfits, with fan attachment, having been placed on the local circuit during the last two weeks.

Sherman, Tex.—The College Park Belt Line Railway Company has a capital stock of $100,000, and will use electric motors. N. W. Lee is president and general manager.

Nashville, Tenn.—The Metropolitan Street Railway Company have asked for a permit to build an electric railroad. John M. Bass and Adolph Dahlgreen are interested.

Bloomington, Ill.—The Daft equipment for the Bloomington and Normal street railway, 13 miles long, will soon be put in. The road has hitherto been operated by horses.

Nashville, Tenn.—The Citizens' Rapid Transit Company, organized by W. H. Mitchell, W. S. Jones, W. B. Rood and others, have asked for an electric railway franchise.

The Chattanooga & Floral Park Street Railroad Company has been formed to build an electric road to Sherman Heights. W. W. Durand, F. P. Henderson, C. F. Bates and others are interested.

Nashville, Tenn.—The McGovern and Mt. Vernon Electric Railway Company, J. Wills, superintendent, want bids for four 125 h. p. engines and boilers, and dynamos. They will also want about 24 more cars. They will equip the whole system as soon as possible.

Jersey.—The Jersey City and Bergen (N. J.) Railroad Company proposes to introduce electric motors on its line, to take the place of horse power. The system to be used has not yet been selected. The Camden horse railway is considering the adoption of the overhead system as used on the Atlantic City Electric Railway.

The Duplex Electric Gas Motor Company has been formed at Edwardsville, Ill, for the manufacture of steam, gas and electric engines and appliances, the building of public works and the manufacture of necessary machinery and appliances for their operation. Capital stock, $1,000,000; incorporators, Jay Noble, F. A. Diergin, J. A. Gumersella, and others.

Motor Management.—We have received from the Hibbard Electric Manufacturing and Supply Company, of Montreal, a copy of the useful rules, handsomely printed on a large card, that have been prepared by Mr. R. T. Engle, superintendent of the company's instrument department, with regard to operating Sprague motors, of which a number are now in service in Montreal.

Seattle, Wash. Ter.—Mr. L. H. Griffith, manager of the Seattle Electric Railway, of the Thomson-Houston system, is well pleased with results. The road has carried 350,778 passengers in 121 days, with 4 cars, each person traveling an average distance of 2½ miles. The cost for fuel, oil, etc., for that period does not exceed $2,000, or only a little more than $4 a day per car for power.

The Sprague Electric Railway and Motor Company's New Orleans office has placed the following motors during the month: Two 7½ h. p., to run an elevator and a machine shop respectively; one 5 h. p. to drive a rotary pump; three 1 h. p. and four ½ h. p., operating ventilating fans. They have also placed the following Edison isolated plants: Two 115-light; one 150-light, and one 40-light.

Denver, Colo.—Articles of incorporation of the Denver Electric Railway Construction Company have been filed. The incorporators are John J. Riethman, Jr., J. A. Brown, Charles F. Musgrove, Frank Evans and George W. Briggs. Capital stock, $300,000. The purpose of the new company is the construction of electric railways and the manufacturing of all appurtenances thereto. The incorporation of this company is the commencement of the scheme to build a system of electric roads as feeders to the tramway company's cables. The system to be used will be the Thomson-Houston.

PERSONALS.

Mr. E. M. Izard, of Chicago, is in London, having been called there by an English syndicate that is desirous of investing in American electrical enterprises.

Mr. E. V. Machette, the new president of the Potter-Compton Electric Company, is said to control the company. He is busily engaged in the real estate business at room F., 111 Broadway.

Frank E. Fisher, of the Fisher Electric Company, Detroit, is about to enter into an arrangement that for making one happy and contented is even superior to "that glorious climate of California."

Mr. J. O. Ellinger, who has been in Europe for some months, has just returned. He is quite enthusiastic about the Paris Exposition, but is patriotic enough to believe that America has little to learn from it in the practical applications of electricity,

George H. Thurston & Co. will continue at 59 South Main street, Providence, the business of electrical engineers and wholesale and retail dealers in electrical instruments and supplies, which has been carried on under the same name heretofore. The new partners are G. H. and W. I. Thurston.

Mr. Henry G. Rice, of the Standard Thermometer Company, of Peabody, Mass., was in the city last week. I had the pleasure of meeting him at the Electric Construction and Supply Company, 18 Cortlandt street, where, by the way, he will make his headquarters for the company's specialties in telemeters, thermometers, and other remarkable instruments of long name, beautiful workmanship, and marvelous sensitiveness for long-distance recording.

Mr. Simon H. Weidenthal, formerly electrician in the Brush Electric Company of Cleveland, and now employed in the same capacity in San Francisco, has just been married to Miss Adeline Levy, of Virginia City, Nev. Mr. Weidenthal had been in Virginia City all last winter superintending the construction of one of the largest dynamo plants in the world, in a tunnel nearly 2,000 feet below the earth's surface, utilized for the reduction of silver in the Comstock mines.

Dr. W. Leigh Burton Honored.—The Committee on Science and Arts of the Franklin Institute of Philadelphia has recommended the award of the Scott legacy medal and premium to Dr. W. Leigh Burton for his electric heater. The city of Philadelphia holds in trust, under a legacy of John Scott, of Edinburgh, a

sum of money, the interest of which is to be used for the encouragement of ingenious men and women who make useful inventions. The legacy provides for the distribution of a medal inscribed "To the Most Deserving," and a premium of $20 to such persons whose inventions shall merit the same.

MISCELLANEOUS NOTES.

Chattanooga, Tenn.—The Kennedy House is to put in an outfit of electric bells. Mr. J. C. Breeding is the architect.

The European Electric Welding Company has voted to increase its capital stock $100,000, making its capital stock $1,600,000.

Los Angeles, Cal.—A big scheme of developing electricity by water power from the river is proposed by Mr. J. Messmer, the chairman of the East Side Board of Trade.

The Norfolk, Va., Electric Couch Company has been formed for the manufacture and sale of electric couches, etc., with Thomas Bottimore as president, and John B. Faulkner, secretary and treasurer.

The Metropolitan Electric Signal Company, of New York City, has been formed with a capital stock of $1,500,000 by C. L. Brown, F. Lynch, J. H. Brown, G. W. Hartt and H. M. Close, to buy, make or lease electric and other apparatus.

Brown's Directory of American Gas Companies, compiled and corrected by E. C. Brown, and issued by the *Progressive Age*, of this city, has recently appeared in its second edition. It is a most interesting and valuable publication, furnishing a vast amount of information. Its price is only $3.

A Banquet to Edison.—A special dispatch from Paris of Aug. 22 says: A banquet was given to Mr. Edison this evening. In a speech Premier Tirard said that France and America were united by indissoluble ties. Mr. Whitelaw Reid, the American Minister, made a brief speech. Mr. Edison said he was grateful for the kindly welcome extended to him.

Kind Words From Washington Territory.—When such a paper as The Electrical World, of New York, is read, amazement is about equally divided between the tremendous progress electrical appliances are making and the ability of the exponent of all that is advanced in electrical theory and electrical practice. The Electrical World is certainly deserving of all praise.—*Tacoma Sunday Times*.

Spokane Falls, W. T.—Advices from Spokane Falls report in regard to the late big fire there, that while both the Edison stations were saved, the offices, motor service, etc., were lost, and the damage reached $50,000. The Spokane Falls Telephone Company lost their plant, to the tune of $20,000, uninsured. The American District Messenger Company lost all its wires and nearly all its boxes, and the Spokane Messenger Company lost about $1,000 on its wires and boxes.

The Standard Underground Cable Company are building a new large two-story factory at Pittsburgh, adjacent to their present works, to be devoted entirely to the manufacture of their standard weatherproof line wire and W. A. C. fire and waterproof wire, the orders for which have steadily and rapidly increased from the time they began their manufacture, a little over two years ago, until now. Although they have already a large capacity, the orders are "away ahead" of them. Orders for cable have also increased very rapidly within the past ten months, so that they are running up to their full capacity in that line. Among the large cable orders received is one from the Western Union Telegraph Company for cable in New York, and one for the Postal Telegraph Company for cable now being laid in Washington City. There are orders in hand also from various telephone companies and from electric light companies in New York City, Washington and elsewhere.

BUSINESS NOTICES.

Battery Cut-Out.—Attention is called to a simple device for disconnecting gas-lighting batteries if accidentally grounded. It is cheap, sensitive, never needs watching, and has no clockwork to be kept wound. Terms furnished by the Electric Supply Company, of Syracuse, N. Y., No. 105 South Warren street.

Patterson, Gottfried & Hunter (Limited), 146-148 Centre street, carry a complete stock of Brush copper, celluvert fibre oiled paper, hard rubber, rod and sheet brass, brass, copper and iron wire, self-hardening tool steel, set and cap screws, machine bolts, machine and wood screws, taps and dies, files and twist drills blowers and forges, machinery, tools and hardware, gear wheels wood pulleys, shafting hangers and belting. General factory supplies.

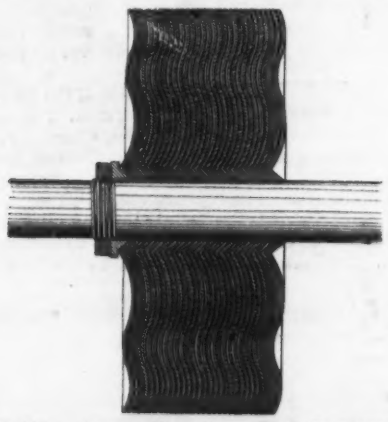
OUR ILLUSTRATED RECORD OF ELECTRICAL PATENTS.

U. S. PATENTS ISSUED AUGUST 20, 1889.

409,170. Electric Valve; Milton C. Wheeler and Albert M. Clark, of Marshalltown, Ia. Application filed Feb. 4, 1889. A valve chamber having a central bore, an angular groove and valve seat in the lower portion of the bore, and a corresponding valve seat at the top of the bore, and a detachable cover, electro-magnets supported by the cover, a branch at one side of the valve, and a port extending from its bore into the top of the valve chamber, a corresponding branch having a port extending from its bore into the bore of the valve chamber at a point between the two valve seats, and a cylindrical tubular valve having annular flanges adapted to engage the two valve seats in the bore of the valve chamber, to be balanced and operated by electric force.

409,178. Secondary Battery; Camille A. Faure, of New York, N. Y., Assignor to the Electrical Accumulator Company, of New York. Application filed April 18, 1888. In an electrical battery the combination of a negative element, a positive element and a diaphragm of septum composed of asbestos, a soluble salt and a silicate.

(1) 409,181. Conductor for Conveying Electricity; (2) 409,182. Distribution of Electrical Energy; (3) 409,183. Joint for Electric Mains; (4) 409,349. Dynamo Electro Machine; (5) 409,565. Distribution of Electrical Energy; (6) 409,566. Distribution of Electrical Energy. S. Z. De Ferranti, of Hampstead, County of Middlesex, England. Applications filed (1) Sept. 24, 1888. Patented in England, Sept. 11, 1885; in France, Dec. 9, 1886; in Belgium, Jan. 8, 1887, and in Italy, Jan. 19, 1887. (2) Feb. 19, 1889. Patented in England Dec. 11, 1885; in France, Dec. 9, 1886; in Belgium, Jan. 8, 1887, and in Italy March 31, 1887. (3) March 30, 1889. (4) Jan. 14, 1889. Patented in England Jan. 15, 1887. (5) Feb. 19, 1889. Patented in England Dec. 11, 1885; in France, Dec. 6, 1886; in Belgium, Jan. 8, 1887, and in Italy, March 31, 1887. (6) Feb. 18, 1889. Patented in England Dec. 11, 1885; in France, Dec. 9, 1886; in Belgium, Jan. 8, 1887, and in Italy, March 31, 1887. (1) The combination of two concentric conductors, consisting of an anterior metallic tube, an exterior solid metallic tube and insulating material filling the space between them. (2) In a system of distribution of electric currents, the combination of an alternating current dynamo generating high tension alternating currents, leads or mains distributing conductors connected with the poles of the dynamo, one or both of said conductors being tubular, said conductors being arranged in proximity, and translating devices connected in multiple between said conductors. (3) A flexible or expansion joint for electric conductors formed of a metal tube corrugated transversely and secured at one end to the end of one length of conductor and at the other end to the next length. (4) In a dynamo electric machine the combination of a revolving armature, a circle of field magnets of either side of it, each carried by a frame divided vertically into two sections, which can be slid away from one another, and spring contact pieces on the sections, which, when the sections are brought together, complete an electrical circuit through the exciting coils of all the magnets. (5). The three concentric conductors, the innermost fed with high tension current, the converter supplied with current from the high tension conductor feeding the intermediate conductor with low tension current, and the outer conductor serving as a return conductor to both the high and low tension mains. (6). The combination of a dynamo-electric machine, concentric conductors insulated from one another leading therefrom, the inner conductor coupled to one terminal of the dynamo, the outer conductor to the other terminal and to earth.



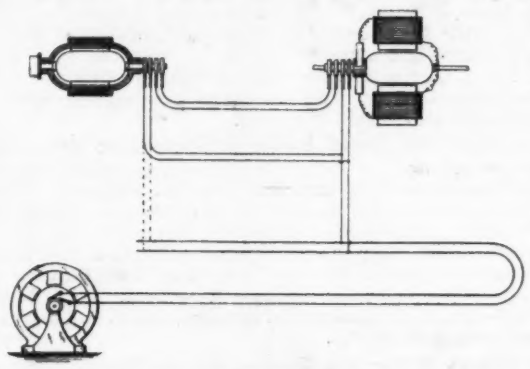
409,463. Armature Core for Dynamos.

409,237. Electrical Railway System; Elias E. Ries, of Baltimore, Md., Assignor by direct and mesne assignments, to Ries & Henderson, of same place. Application filed Jan. 9, 1886. The invention consists, mainly, in providing the cars with secondary or accumulating batteries and suitable devices whereby a certain proportion of the current furnished by the conducting rails is caused to charge said secondary batteries or accumulating batteries, and whereby the current from said batteries may at the proper time be utilized for operating the motors or for several other purposes.

409,259. Galvanic Battery; George Calvin Ward, of Boston, Mass., Assignor to the Advance Electric Company, of Saco, Me. Application filed Nov. 19, 1888. The battery consisting of a zinc element in a solution of sodium hydrate and a carbon element in a porous cell containing a bath composed of trioxide of chromium, an alkaline chloride, nitric acid and water.

409,291. Process of Making Solution Compounds for Galvanic Batteries; William P. Kookogey, of Brooklyn, N. Y., Assignor to the Kookogey Electric Company. Application filed July 3, 1889. The process of making a chromic battery compound consisting of the following steps: First, taking bisulphate of soda and trioxide of chromium manufactured separately; second, dissolving the crystals of the bisulphate by heat without the addition of water, and, third, adding thereto the trioxide of chromium, stirring.

(1) 409,365. Gas Battery; (2) 409,366. Process of Obtaining Electricity from Gas Batteries; Ludwig Mond, of Northwich, County of Chester, and Carl Langer, of London, County of Middlesex, England. Applications filed (1) Nov. 28, 1888. Patented in England, Feb. 17, 1888; in France, Oct. 5, 1888; in Italy, Oct. 13, 1888; in Luxemberg, Nov. 28, 1888; in Turkey, Nov. 28, 1888; in Belgium, Dec. 15, 1888; in New South Wales, Jan. 2, 1889; in Brazil, Feb. 1 1889, and in Spain, Feb. 12, 1889. (2) Application filed March 18, 1889. Patented in England, Feb. 17, 1888; in France, Oct. 5, 1888; in Italy,

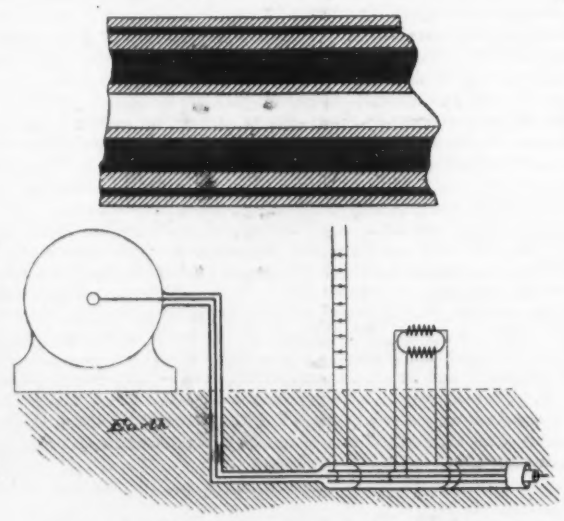


409,449. System of Electrical Distribution.

Oct. 13, 1888; in Luxemberg, Nov. 15, 1888; in Turkey, Nov. 28, 1888; in Belgium, Dec. 15, 1888; in New South Wales, Jan. 2, 1889; in Brazil, Feb. 1, 1889, and in Spain, Feb. 12, 1889. The process of obtaining electricity by means of two gases—such as oxygen and hydrogen—which consists in causing said gases to each come in contact, at or near ordinary temperatures, with a layer of gas absorbing material, itself in contact with the electrolyte, the two layers of gas-absorbing materials being each insulated from the other of them, and each of them connected with one of the poles of the battery, the two gases being interchanged periodically.

409,390. Arc Lamp; Robert D. Carson, of Philadelphia, Pa. Application filed March 25, 1889. The invention consists in the combination of a pair of curved carbon rods and mechanism for supporting the same at an angle in relation to each other, and in the combination, with the carbon supporting devices of feeding mechanism actuated by gravity and controlled by a solenoid, and of an arc forming device operated by the solenoid.

409,437. Electric Dental Instrument; Fred Vernette, of Hannibal, Miss. Application filed June 18, 1889. The invention consists in buttons adapted to be pressed on the human face in the immediate neighborhood of the tooth to be extracted and of a battery connected with the said buttons.



409,565. Distribution of Electrical Energy.

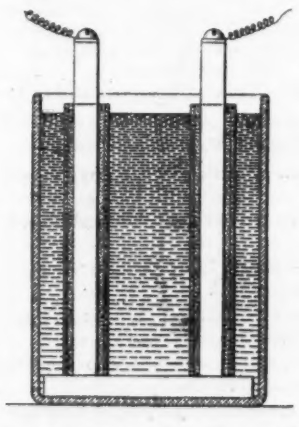
(1) 409,448. Secondary Battery; (2) 409,449. (3) 409,450. System of Electrical Distribution; Charles S. Bradley, of Yonkers, N. Y. Application filed (1) Aug. 11, 1884. (2) Oct. 5, 1888. (3) Oct. 20, 1888. (1) Consists in employing porous cells, plates, or diaphragms composed of some suitable material which is a conductor of electricity, to act while the battery is being charged merely as porous partitions to keep apart the fluids of the battery, and said plates, while the battery is being discharged performing the double functions of separating the fluids of the battery and forming also the negative electrodes of the battery. (2) In a system of electrical distribution the combination of a generator of alternating currents, a pair of mains connected thereto, one or more multiple circuit differential phase electric motors having one circuit connected directly to mains and the other circuit or circuits connected to said mains through an interposed electro-motive phase changing device adapted to change the time period of the currents passing through it. (3) In an electro-motive device, the combination of a field magnet and a rotating armature provided with a current rectifying commutator and brushes therefor, through which current is received into the armature and rotation produced in the moving part of the machine, three current leading devices on the one hand connected respectively into the armature circuit at equidisant points, and so arranged relatively as to lead off three independent series of alternating currents, substantially one third of a phase apart in their relative time periods, and on the other hand connected with three external circuits composed in all of three conductors permutated into the said three circuits, and consumption devices located in each of three circuits,

409,460. Electrical Circuit Closer for Water Indicators; Franklin M. Dunn, Alphonza, Petticord and Joseph H. King, of Baltimore, Md. Application filed March 22, 1889. The combination of a tubular case provided with perforations binding posts for the wires and contact points, a float movable in the case and provided with contact pieces, a perforated jacket around the case, a support for the device, and a gimbal ring connecting the said case and support.

409,463. Armature Core for Dynamos; Daniel Higham, of Philadelphia, Assignor to the Higham Patent Right Company, of Rockland, Me. Application filed May 10, 1889. An armature core for drum winding, consisting of a shaft and a series of thin iron corrugated discs mounted thereon, with intervening air-spaces, but without other insulation than the air spaces.

409,470. Apparatus for Treating Animals by Electricity; Georgiana McGuire Lawrence, of London, England. Application filed April 11, 1889. An important feature of the invention is the provision of means of elevating or raising horses or other animals from the ground, and whereby the difficulties or inconveniences attending the slinging of such animals as hitherto usually practiced are obviated or greatly diminished. The invention comprises means for administering electricity to horses and other animals; and one feature of this part of the invention is the provision of a negative electrode having a very large area of contact surface.

409,498. Combined Gas and Electric Light Fixture; Thomas J. Pierce, of Philadelphia, Pa. Application filed June 19, 1888. Invention consists in a surrounding metallic shell formed integrally with and braced by webs to each member of the flexible joints of the gas fixture, inclosing an intervening



409,178. Secondary Battery.

chamber or conduit adapted to receive insulated electrical conductors required for lighting and support, and protect the same without injury from flexure of the joints of the fixture.

409,508. Electrical Lock; Paul Schwenke, of Zerbst, Anhalt, Germany. Application filed Nov. 16, 1888. Patented in Germany, Aug. 17, 1887; in France, Oct. 3, 1887, and in Austria-Hungary, Feb. 26, 1888. The object of the invention is to produce a lock that may be operated from a distance by an electric circuit, the closure of which may be affected at any time by a circuit closer of ordinary construction.

409,574. Telephone Switch System; Claude C. Gould, of Batavia, Assignor to the Eastern Electrical Manufacturing Company, of Wheatfield, N. Y. Application filed March 12, 1887. The combination with a main line and a movable plug connected therewith of a socket also connected with the main line, a contact lever connected with the generator and provided with a conducting arm and a non-conducting arm and a spring, whereby one of said arms is projected into the socket upon inserting the plug into the socket and a connection made between the main line and the generator.

409,603. Trolley for Electric Railways; John G. Dickson, Robert Dickson and Peter Snyder, of Pittsburgh, Pa. Application filed March 23, 1889. Consists of two series of rollers arranged in a manner that will prevent the trolley from becoming detached from the overhead conductors.

409,628. Safety Fuse for Electric Conductors; Walter S. Bishop, of New Haven, Conn. Assignor to himself and Frank B. Pardee, of same place. Application filed Nov. 23, 1888. It consists in the combination, with the protected fusible strip, of an incombustible non-conducting plate arranged between the fusible strip and the base piece of the safety fuse.

409,646. Brush Holder for Dynamos; James M. McClellan, of St. Paul, Minn., Assignor to George H. Finn and John E. Munson, of same place. Application filed March 20, 1889. An auxiliary brush holder, which is adapted to be detachably and adjustably secured in the ordinary brush holder, the brush being secured in the auxiliary holder, and as worn down moved forward or readjusted.

Copies of the specifications and drawings complete of any of the patents mentioned in this record—or of any other patents issued since 1866—can be had for 25 cents. Give the date and number of patent desired, and address The W. J. Johnston Co. Ltd., Times building, N. Y.